Science and Mathematics Education Centre

The Role Of Students' Perceptions In Modifying Science And Mathematics Classroom Activities

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This thesis is presented as part of the requirements for
the award of the Degree of Doctor of Philosophy
of the
Curtin University of Technology

November 2002

ABSTRACT

The aim of this study was to provide teachers with a practical means to obtain timely indications of their students' reactions to individual activities. Teachers could then modify their presentations of activities cognisant of those students' perceptions. The study set out to establish a suitable instrument, and then to evaluate its use by classroom teachers.

Five experienced science and mathematics teachers identified five characteristics of interest when considering students' perceptions of classroom activities: Understand Content, Communication, Relevancy, Work Output, and Enjoyment. A fifteen-item instrument based upon these characteristics was developed for this study. The viability of the survey for use by busy classroom teachers was increased by the short and succinct format, as well as the provision of a computer graphing template to process and display responses. The combination of the survey and computer template is called the *Students' Perceptions of an Activity Instrument and Display* (SPAID).

Teachers appreciated the provision of a structure to assist their reviewing the use of activities, and the rapidity with which the information was available. Students' responses provided timely support for teachers' decisions to engage classes in the activities and increased teachers' confidence in the worth of the activities. Alterations to activities were small in scale and idiosyncratic to the student cohorts. Teachers' use of the SPAID package was also noted to enhance cooperation with colleagues within the government secondary schools of Brunei Darussalam.

ACKNOWLEDGEMENTS

A written thesis is coincidentally an end and a beginning. What is contained in this volume culminates years of interest, and retaining interest over such a prolonged period would have been impossible without the assistance of many people. My heartfelt thanks go to the following people who provided continued support.

Clive Dobson, who planted the seminal idea that grew. His relentless desire to provide the best in education for his students is exemplary. Clive provided an untiring sounding board to keep the study focused on practicality for classrooms of Brunei Darussalam.

Teaching colleagues who patiently answered my questions, especially the numerous local teachers who sought to explain to me the nuances of the languages used in Brunei Darussalam.

My supervisor, John Malone, for his comments and gentlemanly guidance.

Undertaking a thesis as a husband, father, and fulltime teacher is a highly selfish endeavour. Without the reluctant forbearance of Philip, Mathew, Isaac, and Sophie the task would have been untenable. The greatest acknowledgement is reserved for my wife Jenny, without whose love and support this thesis would have been unthinkable: I.L.D.

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CHAPTER 1

INTRODUCTION

This study was carried out in Brunei Darussalam with the aim of providing classroom teachers with timely and apposite information about students' perceptions of teaching and learning activities. When teachers attempt to improve student outcomes through the use of new or different activities, their impressions of the outcomes profoundly influence their enthusiasm towards similar efforts. Sections of the Ministry of Education in Brunei Darussalam encourage teachers in government secondary schools to move away from traditional instruction styles. However, over a period of time I have noted a disparity between these calls and the reality in classrooms. There is a general tendency for teachers to ignore the ministerial exhortations, and to retain teaching and learning routines that are expected and respected by students, parents, and the general community.

This study considers some of the challenges that limit teachers adopting more varied teaching and learning activities within Brunei Darussalam government secondary schools. The research led to the formation of the package *Students' Perceptions of an Activity Instrument and Display* (SPAID), which, it was hoped, would offer viable assistance to teachers who tinker with ideas that break from traditional praxes. SPAID contains a survey of students' perceptions that focuses on small-scale teaching and learning activities. Support is provided by a computer template that processes the responses and presents teachers with a series of graphs using the automated features in computer programs available throughout Brunei Darussalam secondary schools.

Background

Origin: How It All Began

This study came about as a result of a discussion with a teaching acquaintance in Brunei. We both wanted to try new ideas with students. I was looking to introduce some realistic activities into the textbook world of students' mathematics while he had already engaged classes of students in activities that injected variety into their revision of secondary school science topics. Unfortunately, he had not observed the improvement in their test results for which he had hoped. However, he did believe the activities to be worthwhile, and he harboured aspirations that progress was being made in other areas not measurable through the use of standard testing of content. If this had been so, then the benefits might have taken time to appear, even years, and become evident through avenues such as improved attitude to the subject, better understanding of the scientific concepts, or simply a general interest in ideas scientific.

Linguistic and other differences restrict direct discussions between students in Brunei Darussalam government schools and the many expatriate teachers employed by the Ministry of Education to teach them. My acquaintance and I had experienced this when attempting to ascertain whether students preferred the new activities or the old approaches to teaching and revising. A question we wondered after each activity was *did the students think it was better than traditional methods?* We were seeking practical solutions to practical problems. My colleague had a very pragmatic view of teaching and we established early in the study that any outcome must be closely aligned to the classroom reality of our fellow teachers. From a larger perspective, we were attempting changes to the traditional teaching and learning styles to which the students were accustomed in order to improve their levels of academic achievement

in mathematics and science. If the traditional approaches to teaching and learning were not achieving the results we believed students could obtain, then a change was required. We sought a means to improve the use of new activities with groups of students in Brunei Darussalam. Thus began our interest into educational changes, joining a host of educational researchers who have been attracted, vexed, and intrigued by this topic for many years.

Calls for Change

Teachers throughout the world face numerous and regular calls for reform (Fullan, 1993; Hurd, 1993; O'Loughlin, 1992) but the aims are generally not being achieved (Cuban, 1988a,b; Goldenburg & Gallimore, 1991). The world of education is changing at an increasing rate and a growing sense of need for fundamental educational change is expected to affect all teachers as they adapt to meet new demands (Borko, Mayfield, Marion, Flexer, & Cumbo, 1997; Fullan, 1991, 1993; Kyle, Linn, Bitner, Mitchener, & Perry, 1991; Shymansky & Kyle, 1992b). Unfortunately, enacting the reforms and changes is clearly a difficult matter as traditional practices show a tenacious resilience to change (Deal, 1990; Shymansky & Kyle, 1992b; Tobin & McRobbie, 1996).

Calls for teachers in Brunei to attempt changes and adopt new approaches to teaching and learning are manifest in several forms. Various reports, courses, and conferences provide encouragement for the exploration of new ideas. The central role of teachers in any reform movement is well recognised (Buchmann 1986; Corbett, Firestone, & Rossman, 1987; Fullan & Hargreaves, 1992; Richardson, 1992; Wallace, 1997; Yager, 1992). Unfortunately, the enormous effort and good intentions of organising committees are futile and report recommendations remain highly

commendable but empty grandiloquence unless teachers are willing in their attempts to adopt new approaches.

Situational Constraints

Considerations of any educational change attempt must include the situational constraints under which teachers and students operate (Fullan & Hargreaves, 1992). Teachers in Brunei face conflicting forces that both promote and discourage their attempts at new activities. The remainder of this section outlines some of the constraints that are considered to be relevant to teachers and students in Brunei who, as a result, may be cautious about embracing exhortations to change.

Teachers in Brunei generally are allocated several classes of the same level and the regular punctuation of the year by common tests and examinations has these classes undertaking similar content concurrently. This provides an incentive for teachers to attempt new activities, as time spent in development and preparation can be utilised for several classes. Obtaining appropriate and timely information about the success or otherwise of activities between successive implementations would enable teachers to improve the efficacy of activities through informed experimentation. This is considered a powerful way of developing crucial ownership of the ideas among teachers (Goldenburg & Gallimore, 1991; Wallace, Parker, & Wildy, 1995; Wildy & Wallace, 1994) as well as being helpful in developing teacher satisfaction (Huberman, 1992).

Regular and common traditional testing is the primary form of evaluation applicable to both students and teachers in the Brunei education system. The syllabi required for external examinations are accurately defined and the common tests present checks on the progress of both students and teachers towards completing the required content. An investigation in Brunei Darussalam by Wong, Nannestad,

Veloo, and Lourdusamy (1999) into the concerns of teachers noted the completion of the syllabus to have the highest mean amongst items on Management. Coverage of the syllabus provides a convenient and relatively quantifiable means by which school inspectors measure the performance of teachers, and so can markedly dominate the actions of teachers. Students' percentage results are openly displayed within schools and this can lend a measure of anxiety for teachers, encourage conservatism, and inhibit willingness to explore new teaching strategies (Fullan & Hargreaves, 1992; Hargreaves, 1988; Joyce, Murphy, Showers, & Murphy, 1989).

Attempts that teachers make to introduce changes in approaches to teaching and learning are required to dovetail into existing school evaluation schedules, and with the transparency and close scrutiny of each set of results it can be expected that any variation from the existing procedures will be minor. Tension in the secondary schools is greatly increased among older students who are in years of external examinations. Consequently, teachers are more likely to attempt variations from traditional activities with younger students in the earlier years of secondary education.

Teachers cannot expect immediate cognitive improvements from new approaches to teaching and learning, and this can lead to a preference for the familiar and a reluctance to try new ideas (Tobin & McRobbie, 1996). The traditional levels of achievement provide further reinforcement of traditional teaching approaches. As teachers retrench in their use of traditional teaching and learning techniques their self-perception as professionals diminishes and they retreat in their role (Hargreaves, 1988). Attempts to counter this tendency must be a positive enterprise. This study set out to provide a means to support teachers willing to continue in their exploration of new activities with students.

Brunei has a young and expanding population and it caters for its shortage of teachers by contracting experienced foreign teachers to teach in schools for limited periods. Capable local teachers are required to fill the administrative positions essential if schools and sections of the Ministry of Education are to operate effectively, and this amplifies the effects of foreign teachers upon students in the classrooms. Preference in the employment of foreigners is given to teachers who are male and experienced. Huberman (1988) noted an unequivocal shift in mid to late career male teachers that is characterised by growing serenity at the expense of involvement in factors associated with school improvement. This suggests that the recruitment preference may not augur well for the promotion of imaginative and challenging strategies in classrooms.

Another factor quintessential to the country's traditions is the national concept of *Melayu Islam Beraja* (M.I.B., Malay Islamic Monarchy) which dates back more than six centuries (Brunei Yearbook, 1996). M.I.B. integrates the "language, culture and Malay customs, teaching of the Islamic laws and values, and the monarchy system of administration which must be honoured and practised by all" (p. 75). Adherence to these traditional aspects is expected, and any questioning of the eminence of M.I.B. would be a clear indication of unsuitability. Traditional hierarchical structures permeate government departments and are manifest to teachers through the issue of irreproachable directives. Similar situations as these have been considered to foster teachers' feelings of disempowerment (McRobbie & Tobin, 1995), helplessness (Yager, 1992), or inconsequentiality (Fullan, 1993). Exact limits of acceptable behaviour for job retention can be difficult to determine, however there is no danger of job loss for teachers who adopt the conservative and common actions of other teachers. Following the prevailing instructional trends

procures contract renewal, with the extrinsic rewards of continued employment in a safe, oil-rich, and personal tax-free country. The situation unfortunately limits teachers' interest in embracing the calls for educational change.

Modes and perceptions of communication are influenced by culture (Levy, Wubbels, Brekelmans, & Morganfield, 1994). The all-encompassing terms *climate* and *environment* have been applied to schools, classrooms, and learning for over thirty years (Fraser, 1981a, 1991, 1998a), referring to social-psychological contexts or determinants of learning and includes the "atmosphere, tone, ethos, or ambience" prevailing in the location (Fraser, 1994, p. 493). Classroom environment measures can differentiate between alternative teaching approaches, even when other student outcomes do not (Anderson, Walberg, & Welch, 1969). The quality of the classroom climate is dependent on the nature of the communication between teachers and students and has been found to be important in terms of student learning (Fraser, 1994). Cultural sensitivity is vital in any educational setting and can have strong mediating effects, with activities that are seen by the participants to transgress their beliefs unlikely to succeed (Corbett et al., 1987; Deal, 1990; McRobbie & Tobin, 1995). Teachers may have difficulty appreciating the perceptions of students towards the activities they introduce, particularly teachers who come from cultures, races, and religions that differ from those of the students.

Regardless of the security inherent in emulating existing teaching practices, there are teachers in Brunei Darussalam who do attempt new activities with their classes in line with the calls for teachers to vary their approaches to classroom practice. These teachers tend to be cautious rather than adventurous as they attempt to remain within perceived situational constraints. This study set out to broach barriers to communication between students and teachers in order to provide teachers

with indications of students' reactions to activities, which may be useful in altering the delivery of the activity with other groups of students.

The next section considers comments on the subject of change and potential implications for teachers in the educational milieu of Brunei Darussalam government schools who may attempt to engage students in new activities.

Educational Change Literature

Educational change is complex and elusive (Fullan, 1991; Fullan & Miles, 1992; Wallace, 1997). Teachers around the world are exhorted to instigate changes to their approaches to teaching, and teachers in Brunei Darussalam are no exception. This section first introduces some characteristics and conditions of change and identifies a number that are conducive to adoption in classrooms. The second section outlines the potential role of students' perceptions in guiding teachers' use of new activities with classes.

Characteristics of Change

Characteristics of change cited in literature do little to comfort teachers looking for tranquil adoption of new ideas designed to produce assured improvement in examination results. Early enthusiasm is quickly threatened by the *implementation dip*, the period when things often go wrong before they go right (Fullan & Miles, 1992). Working through the effects of the implementation dip requires time (Fullan, 1991; Richardson, 1992) and among warnings of frustration and discouragement is the comment that significant change can take at least two to three years (Fullan, 1991, 1993; Wallace, 1997). Contracts for foreign teachers in Brunei are for up to three years, which limits their willingness to be involved in attempts at significant changes to the traditional approaches to teaching and learning that are accepted, expected, and respected by students, other teachers, and school administrators.

Change can bring anxiety (Joyce et al., 1989) and be threatening to teachers by invalidating their belief in experiences and confusing their purpose (Fullan, 1991). Anxiety increases when job retention is in part reliant upon students' results from regular traditional testing. Changes attempted within these constraints can be expected to be small in scale, which itself might be considered a desirable beginning (Wallace, 1997).

Disagreement and the voicing of conflicting opinions are characteristic of successful change (Fullan, 1991; Wallace, 1997). Traditional views of secondary school mathematics and science tend towards the existence of a correct answer about which there can be little dispute, so introducing conflict and disagreement into these tidy worlds may be anathema to other teachers and the administrators responsible for contract renewal. Change is not a rational linear process and wariness of adopting new ideas increases as outcomes are characterised by uncertainty, hesitancy, gradualism, and the unspectacular (Fullan, 1991; Fullan & Hargreaves, 1992; Wallace & Louden, 1992; Wildy & Wallace, 1994).

There is little risk to teachers' continued employment when they emulate traditional and prevailing practices and their students obtain examination outcomes that are both accepted and expected by the educational system. The need for considerable personal effort, together with the lack of guaranteed cognitive or affective improvement, form considerable disincentives for teachers even to consider attempting new teaching and learning ideas. Significant intrinsic motivation is required for teachers attempting praxis changes. Despite the barriers, there are teachers in Brunei who do attempt new approaches to teaching and learning. Supporting teachers' early efforts through the provision of information that teachers

consider sufficiently relevant and timely may assist their evaluation and refinement of each activity prior to iterating it with another class.

Conditions Encouraging Change

A recurring theme in the literature is that teachers are clearly in control regarding effective change, with officially proposed or even mandated changes observed to come to nothing if teachers do not adopt then adapt them into classroom reality (Buchmann 1986; Corbett et al., 1987; Fullan & Hargreaves, 1992; Richardson, 1992; Wallace, 1997; Yager, 1992). Teachers are products of their own histories (Fullan & Hargreaves, 1992), subject to personal beliefs and goals which influence their teaching and reinterpretation of external prescriptions (Borko et al., 1997; McRobbie & Tobin, 1995; Raymond, Butt, & Townsend, 1992). Personal perceptions of the effects of new activities strongly influence the enthusiasm of teachers attempting new ideas. The provision of appropriate data assists in the adaptation and improved success of early activity attempts and promotes positive attitudes towards further undertakings.

Teachers operate in the real world of schools and students. Changes need to engage the purpose of the teachers and be seen by the teachers to have a use within the situational constraints under which they operate (Fullan, 1993; Fullan & Hargreaves, 1992; Shymansky & Kyle, 1992a; Yager, 1992). Teachers' interests are therefore grounded in the mundane but very real detail of daily work (Goldenburg & Gallimore, 1991) and it is at this level that changes are considered to be most successful (Deal, 1990; Fullan, 1993). Teachers who initiate changes that originate from a particular need and who set their own agendas for development, have the opportunity to approach issues that they consider to be relevant and appropriate within their own context and beliefs (Borko et al., 1997; Corbett et al., 1987;

Huberman, 1992; Raymond et al., 1992). This study was initiated through a classroom teacher enquiring whether a means existed by which he could gauge the effectiveness of various activities that he was using with students. Consequently, the study had its origins in the real and practical world of the participants. This augurs well for the study to engage in research of use to students and classroom teachers.

All teaching takes place in a context of opportunity and constraint, and teachers use particular activities with students because they consider them to be appropriate for the circumstances (Hargreaves, 1988). Judgements about the worth of new activities should require teachers to be willing to reflect deeply on substantive rather than utilitarian concerns (Fullan & Hargreaves, 1992; Goodman, 1984). Data for reflection are usually based upon own persona and judgements quickly become the norm (Hargreaves, 1988). Deeper reflection requires collaboration to provide other perspectives (Hargreaves, 1992) but there is also the need for any information to be timely and to be viewed by teachers as appropriate and feasible if it is to aid making informed decisions. This study set out to develop a means of providing teachers with such data in order to supplement their personal reflections upon any new activities with students.

Student Perceptions Instruments

The existence of the implementation dip (Fullan & Miles, 1992), the dip in performance immediately following the implementation of a change, prompts turning attention to sources of information other than academic achievement to assess the impact of new activities in which teachers engage students. Educational environments encompass social-psychological contexts or determinants of learning (Fraser, 1994) and the perceptions of both teachers and students influence their

reactions to what happens in classrooms as well as to the various cognitive and affective outcomes (Fisher & Fraser, 1983a,b; Walberg, Schiller, & Haertel, 1979).

There is strong general support for gathering information about classroom or school environments through the perceptions of the students and teachers who are directly involved in those environments, and the use of instruments to obtain perception information is firmly established in educational research (Fraser, 1982b, 1989b, 1994). Not only can the gathering of information by these means be more economical, cover greater periods of time and numbers of students' responses, but they have been found to account for considerably more variance in student learning outcomes than directly observed outcomes noted by detached, outside observers (Fraser, 1989b, 1994; Fraser & Fisher, 1994; Trickett & Moos, 1973).

Several other factors indicate the use of survey-style instruments as apposite for data collection within this study. Anonymity is readily achieved and this is considered necessary for acquiring valid data in this instance. Linguistic differences between students and teachers can be minimised through the provision of translations. Instruments also provide a ready vehicle by which teachers are able to take leading roles in research, a repeated theme in literature (Huberman, 1992; Kyle, 1991; Kyle et al., 1991). Logistic pressures during time in class restrict teachers' flexibility to collect data but instruments readily provide information for processing outside class contact time.

Fisher and Fraser (1983a) indicate that students' preferences for a programme or innovation may be as important as the activity itself in determining achievements and attitudes. Teachers cannot rely on the accuracy of their own impressions, since differences can exist between the perceptions of teachers and students for the same environment (Fisher & Fraser, 1983a; Fraser, Giddings, & McRobbie, 1992;

Wubbels, 1993). A method of obtaining perceptions directly from students in a timely manner will benefit the adaptations of activities cognisant of students' reactions.

Aims of the Study

This study aimed to provide teachers with a pragmatic means to obtain indications of their students' reactions following engaging in new activities. These responses could then contribute to teachers considering alterations to improve the usefulness of the activities with other groups of students. A strong theme of the related literature is the necessity for teachers to be willing in their change attempts and that they need to consider any information as being relevant to their situation (Fullan, 1993; Fullan & Hargreaves, 1992; Shymansky & Kyle, 1992a; Wallace et al., 1995; Yager, 1992). Teachers in this study already had decided of their own volition to engage classes in the activities and had a desire to improve the effect of the activities with other groups of students. Consequently, the first aim was to ascertain information that teachers considered pertinent to their evaluation of activities they try with students. An appropriate method of gathering and presenting this information then needed to be established. These aims prelude the final objective of investigating the influence of student-perception information in the adaptation of activities by teachers.

Research Questions

The following research questions provide a focus for the aims described above:

1. What are the perceptions of students that teachers of mathematics and science in Brunei Darussalam consider pertinent in their evaluation of new activities with classes?
2. Is it possible to establish an instrument that will provide relevant student perception information?
3. What form of presentation of student responses to the instrument do teachers consider readily serviceable?
4. What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?

Methodology

This study set out to assist teachers in Brunei Darussalam to improve the benefit derived from class activities through the provision of timely and appropriate knowledge of students' reactions to those activities. The study consisted of two phases. The first phase provided answers to the first three research questions as it identified student perception information that teachers considered to be relevant, and established an instrument to provide appropriate data. The second phase provided answers to the fourth research question as it investigated the serviceability of this information through interviewing teachers with respect to their modifications of activities.

Data for both phases of the study were gathered from experienced teachers in the Sultanate of Brunei Darussalam who had indicated an interest in the use of new activities with classes. Their opinions were sought throughout the study in order to

guide development and to improve the serviceability of information for other practising teachers. Students involved were drawn from the normal classes taught by these teachers. The study has origins in the teaching of secondary school mathematics and science but the instrument proved to be applicable and useable for a teacher of geography and may extend to other subjects.

Instrumentation

Teachers were asked for aspects of students' reactions that would be of interest to them immediately following trials of new activities. A review of established psychosocial environment instruments revealed that no single existing instrument or potential amalgamation of existing instruments was apposite to the specific nature of the identified characteristics. Consequently, it was decided to construct a new instrument. Potential items from existing instruments were listed and passed to local and expatriate teachers for comment. A short list was formed and discussed with teachers and passed to educational experts for face-validation.

A number of criteria was established to improve the viability of the instrument for classroom teachers, and these guided many of the decisions in the instrument's formation. The aim was to provide information teachers wanted to know in a form readily acceptable to them. The number of items was limited to enable instructions, items, and responses to fit onto one side of A4 paper. Whilst this may have diluted confidence in the findings, a low number of items was thought to increase the receptivity of teachers towards using the instrument, especially if the processing of students' responses required hand-scoring. The prevalence of schools throughout Brunei equipped with computers suggested the suitability of establishing a simple software template to ease data processing. A copy of the computer template is on the floppy disk accompanying this thesis.

The expected ages and English abilities of students with whom teachers are likely to use new activities (and hence the survey of this study) dictated the need to provide a version of the instrument in the local language. A translation of items may have reduced difficulties derived from linguistic differences between students and teachers, but it was also likely to introduce a host of conflicts founded in dialects, interpretations, and styles. Considerable care was required to establish translations of items that retained the essence of intent, conformed to cultural bounds, and provided a safe vehicle for students' expressions. I had limited facility with local languages so had to rely upon native speakers to provide a translation that was linguistically as generic as possible for the country – an extremely difficult task.

The intent of each instruction and item was discussed with a local teacher who formed a local Bahasa Melayu version. An English version was then established from the Bahasa Melayu version. Accuracy of the translation was checked through obtaining back-translations from more than one district and discussing the intent of items with students. Differences in translations were settled by referring options to students from different areas for their preferred version. A copy of the local language version, the English language version, and the teacher's version of the survey are in Appendix A.

A total of 383 student responses to the SPAID survey were processed. Overall, 5 teachers had engaged 20 class groups in 18 different activities. Subjects included mathematics, geography, biology, and general science.

Analysis of SPAID

The evaluation of the SPAID package centred upon the extent to which teachers considered the information provided by SPAID was useful in their evaluation and adaptation of activities. Discussions were initiated by teachers

responding to a parallel teacher version of the instrument, with further reactions being obtained through a series of questions put to the teachers.

Significance of the Study

Students' perceptions are considered to influence their cognitive and affective outcomes (Fisher & Fraser, 1983a; Walberg et al., 1979) but teachers' adaptations of activities are usually based upon their own impressions (Hargreaves, 1992). Differences have been noted between teachers' and students' perceptions of the same environment (Fisher & Fraser, 1983a; Fraser et al., 1992; Wubbels, 1993) which suggests teachers cannot rely on their own impressions to provide an accurate indication of students' reactions to activities. Inaccurate interpretations are likely to increase when the languages, cultures, and religions of teachers differ from those of their students. This study provides a means for classroom teachers in Brunei Darussalam to circumvent these communication barriers and presents them with opportunities to adapt activities with greater cognisance of their students' reactions.

Educational research in Brunei is a fledgling development and this study has opened opportunities for further investigations. The instrument formed for this study lends itself for use as a tool in further research into the effectiveness of specific activities within the Brunei context.

From, By, and For Teachers

There are many calls for teachers to take greater leadership roles in research (Borko et al., 1997; Fullan, 1991; Kyle, 1991; Kyle et al., 1991). This study complied with these as it originated from a classroom teacher seeking a viable means to assess the impact of various activities on students' non-cognitive domains and to improve his teaching practice. I conducted the study as a classroom teacher in constant

consultation with other classroom teachers, and the outcome is for use with the students who comprise ordinary classes in government schools.

The primary function for all participating teachers throughout the period of the study was the improvement in the teaching and learning of students in Brunei Darussalam government secondary schools and all actions and decisions were required to be realistic in their support of this primary role. I required indicators for changes to activities that teachers could effect immediately amidst the bustle of daily school routines. These attempts to improve the efficacy of small individual events were grounded in what Goldenburg and Gallimore (1991) described as "the mundane but very real detail of teachers' daily work lives" (p. 69), considered to be a component of successful professional teacher development. Production of a simple, quick, and easy-to-use instrument opened opportunities for teachers to obtain more realistic knowledge about students' reactions to individual activities. This increased the prospects for the teachers to make small alterations to the activities that improved the outcomes when using the same activities with other classes.

A plethora of established instruments produced by educational researchers provides general indications of students' perceptions of educational environments or climates, and a number are listed in Appendix B. However, there is a paucity, if not void, of instruments that provide specific indicators of students' responses to individual activities. This study provides an instrument and supporting processing template that attempts to fill this deficiency through the provision of practical assistance to teachers seeking to improve their uses of activities.

Satisfaction with the outcomes from one activity will increase the willingness to attempt other new ideas and activities. As individual teachers gain confidence and competence in the use of more varied activities within their daily instructional

routines, other teachers will observe the events and also begin to consider attempting new activities. While this might be seen to comply with the local call for a broader range of imaginative and challenging teaching and learning strategies, the direction of the development is important. Such changes would occur from the teacher following interest that is self-initiated, not from adhering to an issued edict. The changes would be identified by teachers who teach students in classrooms, and be effected by the same teachers for the benefit of the students they teach day after day.

Study Overview

This study consists of five chapters. Chapter 1 has introduced the study, providing the origin of the research and an outline of its rationale. One section outlined the significance of the study within the real world of classroom teaching in Brunei Darussalam government schools, and led onto the aims of the study, the research questions, and the methodology that was employed to seek answers to those questions.

Chapter 2 provides a review of literature that relates to the challenge of attempting educational changes within the context of classroom teaching in Brunei Darussalam government secondary schools and indicates the role of this study in meeting some of the challenges. The first section considers world-wide calls for educational change and several that occur within Brunei Darussalam. Some of the factors that influence the effectiveness of these calls are outlined, including the existence of the gap between the realities of teaching and the world of educational research. Recognised here is the importance of the teachers' role if plans for educational changes are to be realised. Characteristics of educational change are noted from the literature along with some suggestions for implementing change

successfully. A means to help classroom teachers incorporate these within their normal practices then becomes the focus of the study. Finally in this first section, attention turns to the role of the students and the importance that their perceptions play upon teachers' attempts at introducing changes into their praxes.

The second section of Chapter 2 considers comments from literature about the importance that students' perceptions of class activities have in the potency of those activities. Methods to obtain indications of students' perceptions have been developed over the years, and in this study these are related to the daily routines of secondary schooling in Brunei Darussalam.

Chapter 3 presents the methodology used to form the SPAID package and includes measures to enhance the viability of SPAID for teachers within their daily routines. Teachers were asked for suggestions as to what student perceptions would be of interest to them following their use of a new activity with a class. Several existing instruments (Appendix B) were compared against these characteristics as well as the criteria established for the instrument in this study. The limited compatibility between the instruments, the characteristics, and the criteria led to the formation of the survey used in SPAID. Presenting teachers with displays of students' responses was considered important and decisions were influenced by the need to provide classroom teachers with data that are both apposite to their interests and sufficiently timely to be of functional assistance. Chapter 3 outlines efforts to provide teachers with information that they believe is credible, dependable, and transferable within their own daily routines, and this included cognisance of the cultural environment in which data were gathered, and the need for constant consultation with classroom teachers throughout the study.

Chapter 4 examines the results that were obtained through the study. It contains two parts: the first focuses on the formation of the SPAID package, providing answers to the first three of the four research questions: (i)"What are the perceptions of students that teachers of mathematics and science in Brunei Darussalam consider pertinent in their evaluation of new activities with classes?", (ii) "What instrument will provide relevant student perception information?", and (iii) "What presentation of student responses to the instrument do teachers consider readily serviceable?" The second part moves to teachers' uses of the information made available through SPAID, and included are observations of their reactions and the adaptations of activities.

Chapter 5 provides discussions on the findings from Chapter 4 in presenting responses to the fourth research question: (iv) "What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?" The chapter begins with conclusions from the development of SPAID and the subsequent use of SPAID by teachers with groups of students. This is followed by comments on teachers' reactions to the data provided via SPAID and leads on to changes that teachers effected consequential to their consideration of SPAID outcomes. Limitations during the formation of SPAID and the reception of data are then given, opening discussions on further directions of investigation that the study provides. Focus then moves to potential roles for SPAID within larger educational developments.

The study concludes with a discussion on the disparity between the level at which many of the well established educational research instruments operate, such as those listed in Appendix B, and the level of interest for classroom teachers who have the daily responsibility to perform the routines of teaching day after day, year after

year. The established instruments in Appendix B provide beneficial insight into the participants' general perceptions of teaching and learning environments. However, the scale of their interest is larger than the scale of interest for teachers in their daily routines.

Large-scale instruments are referred to in Chapter 5 as being at *macrolevel* as they consider the wider educational climates evident in classrooms and schools. In contrast, the term *microlevel* is introduced to describe SPAID as an instrument that examines the participants' perceptions of small-scale activities that fit within the daily routines of teaching and learning. Macrolevel instruments, as listed in Appendix B, have been used to provide valuable insight into the climates of schools and classrooms. Discussion in Chapter 5 concludes by suggesting the need to integrate macrolevel and microlevel instruments. The meteorological analogy is extended by referring to microlevel instruments investigating the *weather* of classrooms. By improving the impact of small-scale changes in the weather that occurs in classrooms, teachers can have a gradual, but significant, influence on the climate of the classroom.

Two appendices to this study contain examples of the SPAID package being used by classroom teachers in government secondary schools in Brunei Darussalam. They provide evaluations of the viability of the SPAID package to present teachers with timely and useful information. Appendix C contains an expected typical application of SPAID. I, as a teacher, wanted to use the same activity with more than one class, and I required a means to identify potential changes to improve the efficacy of that activity before repeating it with the next class. This appendix outlines the activity and my use of the data available through SPAID to effect changes.

Appendix D contrasts with Appendix C by evaluating the ability of the SPAID package to provide information about an innovative and atypical educational project within Brunei education. The project consisted of a series of environmental activities that focused on an area of jungle near the school. Activities were designed to provide students with applications of content that they may meet later in their studies. The concept was quite different to the course expected by Ministry of Education officials who directed the college to conduct a programme for these students. The absence of traditional routines and evaluation procedures familiar to these officials caused them some concern, and the teachers involved desired an evaluation of the Project apposite to the ethos of the programme they designed. SPAID exhibited a pleasing diversity by providing teachers in this unusual situation with ratification of their belief in the worthiness of the activities, as well as indications of changes to improve the delivery of activities with other groups of students.

Summary

Chapter 1 has provided introductory background to this study. The central theme is to encourage teachers in their introduction of new ideas to students in government secondary schools of Brunei Darussalam. A discussion with a teaching colleague proved to be seminal to the development of the study, which sought a viable means to obtain students' reactions to various activities. The use of new activities aligns with calls for educational changes that occur in Brunei Darussalam just as they do world-wide, and Chapter 1 introduced aspects of educational change from literature that pervade decisions and conclusions throughout this study.

The significance of this investigation rests with the enterprise being grounded in the reality of daily teaching; originating with a teacher's query, being developed

by me in my role as a teacher, and being presented for use by other classroom teachers with students. Existing instruments provide valuable information about the climates of classrooms, but they are problematic in that they have difficulty reaching the day-to-day level that is most important to teachers. The SPAID package developed through this study provides teachers with assistance within minutes of completing an activity with a class. Alterations can then be considered that might improve the usefulness of the activity with the next class. The requirement of pertinent and timely information provides the impetus for the aims of the study and the four research questions. An outline of the methodology has been provided and Chapter 1 concluded with an overview of the five chapters that comprise the study.

CHAPTER 2

LITERATURE REVIEW

Teachers world-wide are persistently presented with suggestions, entreaties, and directives to reform their educational practices (Fullan, 1993; Hurd, 1993, 1994; O'Loughlin, 1992; Shymansky & Kyle, 1992b). Indeed, the presence of change is perhaps one of the few constant aspects of education, but the aims of many of the changes are not being achieved (Cuban, 1988a,b; Goldenburg & Gallimore, 1991). Enacting reforms and changes is clearly a difficult matter with traditional practices showing a tenacious resilience to change (Deal, 1990; Shymansky & Kyle, 1992a; Tobin & McRobbie, 1996). As teachers retrench in the teaching and learning techniques they use, their self-perception of status as professionals is inclined to diminish (Hargreaves, 1988). This study sought a means to support teachers in Brunei Darussalam government secondary schools who do attempt new teaching and learning activities with students in line with national and international calls for change. Any developments were required to fit within teachers' normal classroom routines, as this is the site at which changes are either inculcated into reality or simply ignored to remain as empty grandiloquence.

Chapter 2 is divided into two sections. The first section focuses on educational change and components that are considered pertinent to classroom teachers in Brunei Darussalam. The introductory section begins with the broad calls for change, then moves to calls for change from the South East Asian region, narrowing to specific calls for change within Brunei Darussalam. The chapter continues by noting aspects in literature from past attempts at instigating educational changes and the existence of the gap between the realities of teaching and the world

of educational research. This leads to the importance of teachers in actualising plans for educational changes as well as the contexts in which those changes are attempted. Characteristics of change are then identified, including suggestions from literature for successful change implementation. The first section of this chapter concludes with comments regarding the role of the students and the importance that their perceptions have upon teachers' attempts at introducing changes into their classroom activities.

The second section of Chapter 2 focuses on considerations for obtaining student perception data and the options that have been developed over the years. These are related to the viability for practising teachers to apply the methods of gathering data within their daily teaching routines. Comments from literature indicate suitable approaches apposite to obtaining students' perception information in this study.

Change: Synonymous with Teaching

Teaching as a profession involves the imparting of desired knowledge, skills, and attitudes. By its very nature teaching generates change. Fullan (1993) described teachers as "change agents" (p. 12), a term suggestive of active attempts at generating changes in others. The effectiveness of teachers may therefore be considered a function of their ability to bring about desired changes in others, characteristically students (Fullan, 1993). Subsequently, change may not be viewed as an important component of teaching; it may be considered the cardinal regard. Consideration of teaching demands consideration of change. Classroom teachers benefit from indications of the effect of the changes that they engender during their teaching and learning sessions with students, but this is not always simple to achieve

owing to numerous factors. This study aimed to provide teachers with indications of students' reactions to activities, which may assist them to improve the effectiveness of those activities with groups of students.

Motives for Change

Fullan (1991) considers that there are two main motivations for the introduction of educational innovations. The first is *opportunism*, in which the decisions that result in change are influenced by reasons other than educational merit. Material gain and prestige are examples. These changes have been found to falter following the withdrawal of key elements, such as financial or material support, or change in personnel. The second motivation arises in response to locally identified needs, or *problem solving*. Differences between these two motivations may be characterised by *symbolic* (or what teachers or students seem to need and find useful) versus *real* (or what teachers or students ask for). This study grew from a locally identified need expressed by classroom teachers in Brunei Darussalam. They were interested in obtaining information to aid them to improve the impact of individual activities they were using with classes. Consequently the motivation for this study was problem solving, and close collaboration with teachers throughout the study ensured that this focus was retained, providing real, rather than symbolic, benefit to the world of students in government schools of Brunei Darussalam.

Economic and political pressure. The influence of politics in educational change is undeniable. Concerns about declines of educational standards and national economic competitiveness provide ready sources of calls for educational reformations (Wallace & Louden, 1992). Educational change has been described as "a sociopolitical process" (Fullan, 1991, p. 4), with educational changes and initiatives being subject to arbitrary political shifts in educational agendas (Fullan &

Hargreaves, 1992). Education becomes a readily-manipulated vote-catcher for opportunist politicians during election periods, but such pressure unfortunately promotes the production of quick solutions rather than quality solutions (Apple, 1988; Education Commission of the States, 1991).

The approach to government appointments in Brunei Darussalam is for individuals to be assigned to positions by higher authorities through directives rather than by application. These indefinite periods of appointment present opportunities for the solving of local problems with less regard for politically inspired opportunism. However, it would be naïve to suggest that opportunism does not occur in Brunei, though the milieu of government schools limits the extent to which individual teachers might engage in it. Classroom teachers' salaries are based on their years of service, not the position they hold. Consequently, promotion brings no monetary reward. Limited incentives for opportunism suggests that teachers' participation in this study was motivated by the desire for real problem solving, the improvement of a situation with their students that they identified. This contrasts with involvement originating from factors other than educational merit.

International education comparisons. International comparative studies have become an important means for activating national interests in education (Nebres, 1997). These promote the comparison of students' results from one country against those of other countries (Brown, 1997; Nebres, 1997), and hence by implication, the standing of their education systems. Western education systems have been noted to aspire to the high standing of Asian students in such comparisons, as well as the academic achievements of students who are viewed as Asian within Western educational systems (d'Ailly, 1992; Huang & Waxman, 1994; Sue & Okazaki, 1990; Walberg, 1983, 1984). Brunei Darussalam is a small sultanate in

South East Asia with many educational connections to Western educational organisations. The Western and Asian education systems merge in Brunei at the fundamental level of daily interactions between students and teachers.

Caution needs to be exercised if comparing students and curricula based upon large international comparative studies (Atkin & Black, 1997; Bracey, 1996; Brown, 1996). One problem is that they identify correlations, but not causations (Brown, 1997). The adoption of a particular practice prevalent in high-scoring countries is no guarantee that desired benefits will follow. All education authorities aspire to lift the standing of their students but they also need to be mindful of the need to retain traditional values (Hurn, 1983). Teachers who introduce new teaching activities from one country or culture into another must be cognisant of the contrasting educational and societal milieux that can influence the potency of changes.

Brunei Darussalam has a fledgling educational research and development environment that is beginning to generate ideas to improve the teaching and learning within government schools. Many of the ideas teachers obtain from seminars, conferences, and publications have origins outside the country. Local teachers who are enthusiastic about using these with students in government secondary schools may be aware of improprieties within the activities and are able to change the content or delivery to avoid offence. Expatriate teachers with a predilection for using new ideas may not realise the existence or importance of these potential blunders. The provision of a viable means to indicate aspects of activities that detrimentally conflict with a societal norm must be beneficial to these teachers. They would then be in a position to consider alterations that might improve the impact of the teaching and learning occurring moment by moment, day after day in classrooms.

Greener pastures of international education. It is of considerable irony that whilst Western countries fret over the inability of their students to produce the academic achievements of Asian countries in international comparisons, there is lamentation in parts of Asia over the inability of students there to adopt certain educational traits of the West.

Brunei Bonds: Malaysian Culture, Singaporean Education

Brunei may be politically and financially independent of neighbours but its size prohibits isolation. Malaysia geographically borders Brunei Darussalam and bonds with Brunei are evident through the promotion of the Malay language, culture, and customs as the first of the three-part national M.I.B. concept (Brunei Yearbook, 1999). Strong educational links exist between Brunei and Singapore, demonstrated through the adoption of Singaporean mathematics and science textbooks as standard issue for Forms 1 to 5 students at all government schools in Brunei. The mathematics syllabus of the lower secondary schools in Brunei (Curriculum Development Department, 1994) parallels the content and order of these state-supplied textbooks that were developed for use in Singapore by the Curriculum Department Institute of Singapore in 1991 (Curriculum Department Institute of Singapore, 1995).

Both Malaysia and Singapore outwardly encourage educational change, with public expressions that independent thought, a characteristic considered to be fostered in the West, is viewed as desirable in the drive for progress. A history professor at the University of Malaysia is quoted as saying, “We look for some spark. But [the students] don’t know how not to conform. And if all you do is conform, how can you achieve a breakthrough?” (Silverman, 1996, p. 24). As a young, multiracial nation, Malaysia has “emphasised political peace and quiet over

academic freedom and excellence. It had its reasons and it can point to its results – decades of social peace and robust growth" (Silverman, 1996, p. 24).

Educational standards in Singapore are highly respected in the South East Asian region. However, calls for change are becoming well publicised.

> Many students and academics in Singapore say the country faces a pitched battle in overcoming its image of a politically-throttled bastion of Confucian conservatism, and that no money can buy the heady, open cultural atmosphere necessary for higher learning. … Singapore's much-touted "Asian values" could work against the country's academic ambitions by discouraging two-way dialogue in the classroom. ("Dubious hopes", 1997, p. 19)

In such a competitive environment as Singapore, there is often a "quest for excellence and thirst for knowledge and high performance" (Teh & Fraser, 1993, p. 42). A survey of teachers' concerns in Brunei by Wong et al. (1999) identified pupil's apparent lack of interest and motivation to study as having the second highest level of concern for secondary teachers (p. 25). This result suggests that there may be essential differences in students' reception of education between Brunei Darussalam and Singapore, exemplifying the potential for difficulties when transporting a practice across national or cultural boundaries.

Students receive mixed messages. Students in Asia have avoided complicating their academic progress with detrimental political entanglements by evading public expression of personal opinions. It must be difficult for students to reverse or even challenge the traditionally accepted and successful routes to academic accomplishment. In this regard, Silverman (1996) contended that Malaysia not only has work to do, it has work to undo.

Calls for Change in Brunei

Calls for changes to general styles of teaching evident in Malaysia and Singapore are reflected in Brunei. These have increased in recent years and are propagated through a variety of sources.

Public awareness. Public awareness has been aroused through newspaper articles such as *'No' to spoon feeding* (Appendix E), which suggests the need to move away from methods of instruction that the article labels as "spoon feeding". While the accuracy of information in such published articles may be uncertain, they do bring educational issues to the attention of the general population and raise the question of what methods of instruction are appropriate in Brunei Darussalam government schools. Teachers who attempt a variety of styles or activities need a means of comparing outcomes so as to develop an awareness of inherent advantages and disadvantages. This study involved the development of an instrument that can support teachers in comparing students' perceptions of activities, and which can be combined with other forms of assessment in the evaluation of teachers' trials of new activities.

Teacher awareness. Veloo and others (Veloo, et al., 1993) in a report to the Ministry of Education made several recommendations to improve the mathematics results of students in Brunei Darussalam government schools. Amongst these were "Teachers must be made aware of a wide variety of teaching styles either through literature or more importantly through regular workshops and in-service courses" (p. 40) and "Teaching through practical activities and investigations should be practised where possible" (p. 40). Educational authorities in Brunei actively encourage teachers' awareness of the opportunities for developing new strategies in their teaching. Teachers are directed to attend seminars to upgrade their practices in

schools (Abu Bakar, 1996). Additionally, the Ministry of Education sponsors one or two teachers from each secondary school to attend annual international conferences which are organised by the Department of Science and Mathematics Education at the Universiti Brunei Darussalam, and focus on various issues in science, mathematics, and technology education. These send clear messages of support for teachers to consider adopting changes in their approaches to teaching and learning in the classrooms of government secondary schools. In addition, ideas for new teaching activities are readily available to teachers in Brunei through the seminars and accessible publications such as the *Science, Mathematics and Technical Education* published by the Department of Science and Mathematics Education, Universiti Brunei Darussalam, and distributed free to secondary schools. However, for teachers to consider using the new ideas with students in classrooms they should also have useful practical support for their efforts, and this study set out to establish such support.

Further calls within Brunei for pedagogical change come from educational research. One study that probed the prevalent use of photocopied notes that science teachers in Brunei provide to students led Tairab and Salleh (1997) to question the effectiveness of this established practice in its popular form. While teachers viewed these notes as encouraging independence, in contrast, Tairab and Salleh found students' dependency increased through their use. Consequently, they suggested that teachers need to devise and integrate active reading and comprehension strategies into an interactive constructivist model.

Teachers are being encouraged to explore different strategies that support students' learning, but to do so they require a means to assess the impact of the new ideas they use with students. The instrument developed through this study offers a

practical means that enhances teachers' judgements of the impact of the new ideas on students. Through considering the results of teachers' efforts with new ideas, research and literature can begin to focus on the outcomes of teachers' efforts to introduce changes rather than merely continuing the calls for changes to occur.

School inspection report. Formal school inspections by a team of school inspectors occur in Brunei Darussalam government schools. Following the inspection of one school with a strong tradition of examination success, selected comments from the inspectors were promulgated to the staff of that school. These contained clear calls for the use of more diverse teaching and learning strategies:

> A broader range of teaching and learning strategies should be employed to meet the needs of the wide ability range. …This demands the ability to plan and differentiate teaching materials for a range of abilities…There is often an overuse of handouts and worksheets restricting the opportunities for analysis, creativity and independent thinking. Little attention is given to students carrying out individual project work, field work and other practical investigations related to various subjects…More could be achieved by the use of imaginative and challenging teaching and learning strategies. (H. B. G. Lim, personal communication, February 1, 1997)

Teachers in Brunei government schools face a dilemma similar to that of the university students in Malaysia. Should they ignore calls to adopt changes and continue to achieve examination results that are expected by authorities and the public, or should they move into unknown domains and attempt changes that will give uncertain results? Any move into the unknown should be supported by indications of worth. Was the interruption to normal practice worth the effort? Should it be tried again? Are there ready changes that might improve the efficacy?

Teachers need realistic answers if they are to attempt to implement new ideas and activities with students.

Examination control. The style of the traditional examinations purchased from the University of Cambridge Local Examinations Syndicate has a forceful influence upon the aims of Brunei education at the secondary school level. Gradual changes towards a greater emphasis on conceptual understanding and application have been noted in these examinations (Lim, 1997). The O-Level (Form 5) Chief Examiner's Report in 1996 indicated that students generally have had difficulty coping with some of the changes (University of Cambridge Local Examination Syndicate, 1996), which suggests the requirement for a change in teaching approaches from those styles traditionally employed. Although existing teaching approaches can produce results that are expected by educational administrators, parents, and students, there are teachers who do attempt variations from the usual activities with the intention of improving the teaching and learning that occurs. It is these teachers that this study supported by providing pertinent and timely information to benefit their evaluating the worth of the activities they introduce to students.

Attempts at Educational Change

Past Attempts: Justified Legacy of Resistance?

There has been a plethora of education curriculum innovations world-wide over the last 30 years (Cuban, 1988a) and the rate at which these occur shows signs of increasing (Lester & Sowder, 1996). Good ideas are necessary but not sufficient to bring about educational changes (Fullan, 1991), a consideration manifested by George Bernard Shaw's comment that "reformers have the idea that change can be achieved through brute sanity" (cited in Fullan, 1991, p. 97). There have been many

well-deliberated attempts at educational changes to which schools have proved highly resistant (Futrell, 1988). Whatever the reasons for failed reforms, it is evident that the aims of educational changes have not been met (Goldenburg & Gallimore, 1991). This negative legacy of failed reform over many years has given the notions of change and innovation bad names (Fullan, 1991). Perhaps one of the greater outcomes from the myriad of educational changes is a general strengthening of teachers' obdurate attitude towards change, having developed a justified wariness of the successive changes they are required to endure. The legacy of resistance suggests that any calls for change by authorities in the Ministry of Education in Brunei be destined for similar ends unless they are cognisant of, and cater for, barriers to teachers adopting the changes within their classroom practice.

Teacher–Researcher Gap

One contributing factor suggested for the failure of early reform efforts is that they were based upon faulty and overly abstract theories, being unrelated to practice, due to researchers having limited or no contact with, and understanding of, the school (Atkin, 1989; Fullan, 1991; Kempa, 1997; Malone, 2000). "Many teachers and administrators believe – and *say*, with conviction – that educational research is irrelevant, wrong-headed, or both" (Atkin, 1989, p. 200). On some occasions researchers' solutions to real and critical problems have been considered by school authorities to compound the crisis rather than present a tangible solution (Hallinan, 1996) as well as to alienate teachers from participating further in reform (Fullan & Hargreaves, 1992). Consequentially, teachers are extremely wary of changes introduced by academics (Fullan, 1991).

Shanker (1988) provided an example of how teachers may be readily alienated from the research base in the article *Reforming the Reform Movement*. This

article concludes by stating that “the time is ripe for bold departures” (p. 372), but the emphatic statement is immediately followed by conditional qualifiers that include; school restructuring facilitating flexibility to enable matching students with appropriate learning experiences that necessitate small groups and heavy teacher input, vastly expanded use of technology, solving the staffing crisis, and extensive and varied support staff. All these have considerable financial implications and classroom teachers who read these qualifiers would realise the time is nowhere near ripe for bold departures. Any positive impression Shanker was trying to make was clearly not directed towards classroom teachers. Such lack of reality cannot induce teachers to closer relationships with researchers, and merely reinforces the gap between them.

Writers of the calls for educational changes are usually safely distanced from the effort and responsibility of implementation, and the deluge of calls appear to be matched by a dearth of tried and successful suggestions as to how the changes might be brought about. Research into science and mathematics education and the practice of science and mathematics teaching have generally coexisted as parallels, rather than being convergent. This has partly been achieved through a lack of interaction between researchers and practitioners (Kempa, 1997).

There is growing awareness of the gap between research and teaching communities, as well as the need to find a means of promoting communication and interaction for their mutual benefit (Malone, 2000). If research is to be relevant to the reality of schools, teachers, and classrooms, then researchers need to address issues that are both important and potentially beneficial to the practice of education (Kempa, 1997). This concept was behind the Concerns of Teachers survey conducted in Brunei (Wong et al., 1999) which sought to identify the relative importance of

various classroom teachers' concerns. Similarly, identifying and addressing issues real to teachers was quintessential to this study, seen as a step in bridging the gap between teachers and researchers.

Teacher-researcher collaboration. Symptomatic of the teacher-focus approach to educational research are numerous calls for teachers to be actively involved in research, (Atkin, 1989; Borko et al., 1997; Fullan, 1991; Gervasoni, 1994; Hallinan, 1996; Kempa, 1997; Kyle, 1991; Kyle et al., 1991) and for research to relate sensitively to the realities of classroom practice (Atkin, 1989; Borko et al., 1997; Fullan, 1991; Fullan & Hargreaves, 1992; Futrell, 1988; Goldenburg & Gallimore, 1991; Kempa, 1997; Kyle et al., 1991; Theissen, 1992), as well as research being cognisant of the wider community in which schools are situated (Hallinan, 1996; Wimpleberg, Teddlie, & Stringfield, 1989). These calls tend to conclude with reiterating the need to find ways to convert research into classroom reality, which are laudable statements but fall short of providing both teachers and researchers with practical and proven suggestions about how to do so (Malone, 2000). The remarks remain safely distant from reality and further teachers' obdurate resolution to remain alienated from researchers. This study moved into the middle ground, providing classroom teachers with a viable means to support their attempts at the changes they are called upon to make.

Teachers will be allocated ancillary roles in educational research until they are afforded opportunities to be active participants who identify key questions, establish the research agenda, and interpret the findings (Kyle et al., 1991). This would counter the traditional participation of teachers in research, roles that Atkin (1989) considers to have been marginal and to have been for the benefit of academic expectations characterised by "placing the highest value on the generation of theory

rather than on the amelioration of practical problems" (p. 205) as well as the "propensity to value methodological rigour over verisimilitude" (p. 204). In this study I, the researcher, was a teacher, and the other teachers that the study involved were unlikely to tolerate their time and energy expended in directions they considered to be neither practical nor viable. All teachers in this study had to perceive that the ideas aligned with their own views of classroom realities if they were to participate.

Centrality of Teachers

After many decades of difficulty in actualising innovations in classrooms, the direction of interest turned to the teachers. Rather than looking for a solution *without* teachers, researchers began looking *within* teachers (Atkin, 1989; Borko et al., 1997; Cobb, 1988; Fullan, 1991; Fullan & Hargreaves, 1992; Futrell, 1988; Gervasoni, 1994; Goldenburg & Gallimore, 1991; Jones, 1995; Koehler & Grouws, 1992; Kyle, 1991; Kyle et al., 1991; Lieberman & Miller, 1981; O'Loughlin, 1992; Richardson, 1992; Shymansky & Kyle, 1992a; Theissen, 1992; Wallace, 1997; Wallace & Louden, 1992; Wildy & Wallace, 1994). The 1990s recognised the importance of the teacher, with Fullan (1991) considering them as quintessential: "Educational change depends on what teachers do and think – it's as simple and as complex as that" (p. 117). Irrespective of the worth researchers may place on their findings or the belief educational administrators may have in proposed improvements, teachers will make their own judgements about the suitability of changes based upon their own knowledge and perceptions of relevance (Kempa, 1997). Without action in classrooms by teachers the calls and even mandates for change remain unattended by teachers (Buchmann, 1986; Fullan & Hargreaves, 1992; Wallace, 1997). Since teachers have the most direct influence on what happens in the classroom, it is fair

that they should retain control of decisions to improve learning. Consequently, decisions in this study were continuously referred back to the teachers and at times students, these being the participants destined to benefit.

Brunei Context for Change Attempts

Realising the importance of teachers as people in effecting educational changes and the need to be cognisant of the context of their efforts to do so leads to some comments regarding how these may be seen to interact within the culture of education in Brunei Darussalam. There are boundaries within which teachers employed by education authorities in Brunei are expected to remain. Some boundaries are clear. The national concept of M.I.B. "integrates the language, culture and Malay customs, teaching of the Islamic laws and values and the monarchy system of administration which must be honoured and practised by all" (Brunei Yearbook, 1996, p. 75). Deviation from this primacy is unlikely to be tolerated.

Other boundaries of acceptable behaviour are not so distinct, especially for teachers from other countries, cultures, and religions, who may be unaware of some offences they generate. Broaching these boundaries may be costly in terms of nonreceipt of annual bonuses and not having teaching contracts renewed. The safest path for teachers is to adopt the prevalent classroom practices that are expected and respected by students and society. Unfortunately, this does not augur well for teachers' adoption of new approaches to teaching and learning.

Is the new idea better than the old? It is fair and necessary for classroom teachers anywhere to ask why they should commit considerable time and effort into altering their pedagogical practices. The general standard of results that Brunei students obtain in external examinations has become inculcated as normality and any activity that may be construed as threatening to that normality may be undesirable,

especially should the outcome of that activity be uncertain. Regardless of difficulties that teachers face when introducing changes, there are teachers in Brunei who do attempt changes in their teaching and learning practices. Some instructional procedures may be more appropriate for some students than for others (Kempa, 1997) so teachers need to be cognisant of the differences. Students and teachers deserve concrete evidence that the called for alternatives have advantages over the existing accepted approaches and activities (Borko et al., 1997). This study originated from an acquaintance asking if there were a means to find out what students thought of the various teaching and learning activities he was trying with them. He wanted to know if the students thought the activities were *"better*" than what was usually done in class. This study looked to supply teachers with answers to these questions that recognised students' reactions to those activities.

Teachers: Products of Their Histories

Educational changes require teachers in classrooms to turn the calls for change into real actions on a daily basis (Lieberman & Miller, 1981). Teachers are products of their own histories and the influences of these histories are well recognised in literature (Fullan & Hargreaves, 1992; Wallace & Louden, 1992; Wildy & Wallace, 1994). Attempts at teacher development and educational change will meet with little success unless they engage with the purpose of the teacher and acknowledge the person that the teacher is (Hargreaves, 1992; Louden, 1992). Actions by teachers participating in this study needed to be considered in context with their professional and personal histories, as well as the wider school and social settings (Fullan, 1991; Fullan & Hargreaves, 1992; Kyle et al., 1991; O'Loughlin, 1992; Wildy & Wallace, 1994).

Teacher Profiles

In the present study, aspects of the profiles of teachers employed to teach in government schools of Brunei Darussalam were matched against literature and possible implications for teachers' receptivity to the calls for change. The two broad classifications of local teachers and expatriate teachers are now reviewed.

The education system in Brunei Darussalam has grown rapidly over the last few years to cater for the expanding and youthful population of the Sultanate (Brunei Yearbook, 1996). Several new secondary schools have been built and opened over this period and the Ministry of Education has created new departments and units, leading to increased need for teachers at all levels and administrators to staff the schools and departments (Ministry of Education, 1997). Local teachers are posted to fill these vacancies wherever possible. Those with the initiative to attempt innovative classroom practices may be noticed early in their careers and be selected for promotion. Whilst this may be an appropriate reward, it would remove from classrooms the model of local teachers trying new ideas with students. Consequently, students have limited exposure to experienced local teachers who incorporate a variety of activities into their classroom practice.

The Sultan Hassanal Bolkiah Institute of Education within the Universiti Brunei Darussalam prepares schoolteachers and runs postgraduate courses for educational administrators and classroom teachers. The numbers of graduates each year have been increasing, but the required number of classroom teachers remains greater than the supply. Shortfalls are filled through the Ministry of Education recruiting expatriate teachers from overseas countries to fill these teaching positions. The most recent statistics available to me through the Ministry of Education indicate

that the number of local teachers exceeds expatriate teachers by a ratio of approximately 2:1 (Table 1).

Table 1

Numbers of Male/Female and Local/Expatriate Teachers in Government Secondary Schools – Summary Statistics (1993)

	Male	Female	Totals
Local Teachers	548 (32.1%)	593 (34.8%)	1141 (66.9%)
Expatriate Teachers	313 (18.4%)	251 (14.7%)	564 (33.1%)
Totals	861 (50.5%)	844 (49.5%)	1705

Source: Ministry of Education, Brunei Darussalam
http://www.brunet.bn/php/sutmoe/govsec.html

The removal of classroom teachers to fill necessary administrative positions and to teach subjects considered best taught by local teachers, such as M.I.B. and Bahasa Melayu (Malay Language and Literature), alters the above ratio of teachers in classrooms for subjects such as mathematics and the sciences. Biodata of teachers who responded to a survey of class teachers' concerns (Wong et al., 1999) suggested that the majority of teachers standing before classes in government schools in these subjects slightly favours expatriates. Consequently, the importance of the profiles of expatriate teachers increases.

Attempting to determine patterns of teacher development as they spend years in the profession gathering knowledge and experience is not a simple task. Each teacher is an individual, exceptions abound, and copious moot contentions confound conclusions. Consequently, any finding needs to be viewed more as a suggestion

than as a clearly defined category. Two aspects of the recruitment of expatriate teachers, age and gender, will now be considered regarding potential influence on the adoption of calls for educational change.

Age. Huberman (1988) observed that teachers moved through general stages in their teaching careers. Initial uncertain beginnings lead to a period of stabilisation, followed by attempts at diversification and experimentation, this being a widening and expanding of interest, taking in new challenges and renewal of interests. These earlier stages Huberman considered generally evolved over the first ten years or so of a teacher's career (Table 2).

Table 2

Generalised Stages of Teachers' Careers as Suggested by Huberman (1988)

0-6 years	4-8 years	6-10 years	??	
Initiation→	Stabilisation→	Experimentation/ Diversification→	Positive focusing	Decreased activity
			Defensive focusing	Disengagement
			Disenchantment	Increased confidence, less vulnerability
Uncertainty	Stability	Expansion/ Widening	Contraction/ narrowing of interest	

Huberman (1988) noted older teachers as having increased serenity, confidence, and efficiency. These traits would be desirable to Ministry of Education recruiters as they risk considerable financial investment in the employment of expatriate teachers. However, there was reciprocity of "growing serenity at the expense of lessening involvement" (p. 129). Characteristics include less energy, less activism, less involvement, less idealism, and more pessimism. The surer teachers become of their own ability, the less receptive they appear to become towards considering alternatives, including the called-for innovative approaches to teaching and learning.

A clear trend was observed. “Over time, these teachers see themselves as less willing to invest as heavily in their careers and, more specifically, in attempts to change local practices” (Huberman, 1988, p. 128). There appears to be a trade-off between employing experienced teachers and the encouraging of innovative teaching. The implication is that the preference for employing experienced expatriate teachers in Brunei may run converse to calls for converting educational change into classroom reality. Huberman’s 1988 study focused on teachers with greater homogeneity than that in the Brunei situation where teachers originate from a range of countries, religions, races, and experiences. Whether his observations translate across international, cultural, racial, and religious borders presents opportunities for further investigation.

Gender. In line with the religious view of the husband being the provider for the family, preference in recruitment by the Ministry of Education for employment purposes is given to males. Men are likely to be awarded full contracts and benefits while their wives may be employed on more limited month-to-month or day-to-day contracts. When females are employed on full contracts, their conditions of service may not be identical to male counterparts of otherwise equal standing, exemplified by differences in available allowances.

Discussions about changes in life cycles indicate that while men move from active to passive mastery modes, women move in the opposite direction (Neugarten, 1979), and the general pattern for age mentioned in the previous section was considered more acute in males than females (Huberman, 1992). One possible explanation may emerge from the female teachers taking time away from full-time teaching at some stage in their careers in order to raise a family. The result is their having experienced outside interests of a different nature to their male colleagues,

due to family rearing responsibilities. On return to the classroom, they become well experienced at having to balance school tasks and out of school interests. The level of adaptability of female teachers would be a desirable characteristic in teachers who are encouraged to adopt innovative practices, though is perhaps in contrast with the Brunei preference for male employment that is concomitant to prevailing social, cultural, and religious mores.

Attempts by classroom teachers in Brunei to heed the calls to adopt changes in approaches to teaching and learning may be difficult under existing conditions. Teachers who do make the effort to try new ideas deserve support and encouragement for their efforts. This study sought to provide such teachers with assistance in a form that they considered to be viable within their daily practices.

Beliefs and Knowledge

The beliefs and views that teachers hold about the subject they teach profoundly influence their teaching and their facilitation of change (Borko et al., 1997; Cobb, 1988; Koehler & Grouws, 1992). Teachers' adoption of change within their classroom routines requires a combination of belief in the changes and sufficient knowledge about how to inculcate those changes into reality (Borko et al., 1997).

Beliefs. Teachers' beliefs about education and teaching have been accumulated over many years of class-based experience and are influential in any attempt at instigating educational change (Cobb, 1988; Koehler & Grouws, 1992). Difficulties can arise when teachers participate in programmes that question their long-held values about teaching (Fullan 1991; Wallace & Louden, 1992), with activities seen by the participants to transgress the sacred beliefs being unlikely to succeed (Corbett et al., 1987). Teachers' beliefs serve to filter new ideas and "when

teachers' beliefs are incompatible with the intentions of the development team and are not challenged, the teachers are likely to either ignore new ideas or inappropriately assimilate them into their existing practices" (Borko et al., 1997, p. 270). To suggest to teachers that their own respected practices are inadequate or inappropriate has the potential to reinforce obdurate attitudes towards changes.

A means by which researchers may attempt to circumvent unwilling participants in studies is through using volunteers. Curiously, Wade (1985) comments that there is no significant difference in training effect size whether the participant is a volunteer or is volunteered. Fullan (1991) has suggested that a contributing factor for even volunteer groups frequently failing to produce the changes perceived by developers is that they are excluded from participation in the evolution process of the ideas. Those advocating new ideas have undergone processes through which they have acquired personal meaning of the particular changes under consideration.

The sharing of ready-to-use activities with colleagues may appear to be a sensible conclusion to teachers developing activities with students, but to do so provides limited opportunities for the recipients to work through the meaning of the changes for themselves. Greater benefit may be gained through presenting teachers with ready-to-alter worksheets that require completion or adaptation before being engaged with students. This provides teachers with higher levels of ownership of the process of development, which is an element of creating an empowering educational environment (Richardson, 1992).

The concept of ownership is important but there are practices in Brunei Darussalam that may limit teachers' affinity to schools. One example is the method of reallocating teachers to other schools. The ever-present possibility of being

transferred to another school with neither consultation nor warning has the potential to inhibit teachers' will to expend their time and energy to develop a bond between themselves and the school to which they are currently assigned. This barrier is heightened for expatriate teachers hired on three-year tenures. Sizer (1984) wrote, "Teachers are often treated like hired hands. Not surprisingly they often act like hired hands" (p. 184). Teachers' competence and efficiency are closely tied to personal senses of worth and value. As teachers retrench in the teaching and learning techniques they use, their self-perception of status as professionals diminishes, and "status denial can lead to role retreatism" (Hargreaves, 1988, p. 225). If teachers are to be interested in change attempts they need to believe that their efforts can make a difference and that they have some control over what occurs. This study established a tool to assist teachers to consider alterations to activities in order to improve the effect of those activities with students, providing empowering ownership that is harmonious with developing changes in teachers' beliefs.

Knowledge limitation. A hurdle for teachers attempting to implement new ideas is that they may have neither the knowledge nor the skill to implement the innovations (Borko et al., 1997; Wallace & Louden, 1992). This may apply to many teachers in Brunei but must not be considered an indictment against them. Rather, it must be appreciated that the new ideas may be beyond the experiences of some teachers, whose existing knowledge and proficiency as teachers are acknowledged and highly respected by the community.

The enthusiasm of many calls for changes in the literature noted previously in this chapter was matched by the reluctance of the authors to provide useful, viable, and specific suggestions to those teachers who are required to effect the calls. The quotation given earlier in this chapter that was extracted from the school inspectors'

report following their inspection of a school contains wonderful ideas. There is little doubt that "more could be achieved by the use of imaginative and challenging teaching and learning strategies" (H. B. G. Lim, personal communication, February 1, 1997). However, the teachers were left alone to do any selection, preparation, implementation, and evaluation of strategies after the inspectors had been moved on to other tasks.

Teaching and learning activities need temporising cognisant of the environment in which they are to be used. If teachers are required to undertake the implementation of new strategies without outside assistance, then they need a means by which they can try new ideas and consider the outcomes to accumulate new knowledge that augments their existing expertise. This study provided a link between the calls for teachers to adopt new activities with students and their doing so. Through assisting teachers to improve the impact of their early attempts with new activities, their receptivity of the activities may increase and the called-for approaches become inculcated into reality.

Context of Change in Brunei Darussalam

The importance of the context or situation in which knowledge is founded and applied on a daily basis is important when considering the impact of any change on the participants (Borko et al., 1997; Bredo, 1994; Brown, Collins, & Duguid, 1989). "Community values often influence instructional practices" (Shymansky & Kyle, 1992a, p. 766), with contexts providing both the opportunities and constraints that coexist in teaching (Hargreaves, 1988). The view of situated cognition suggests that if teachers are to learn to teach in new ways, the knowledge they acquire as they develop new activities must be grounded in the classroom contexts in which they will be used (Borko et al., 1997). Two contexts influential for teachers in Brunei

Darussalam are the treasured traditions that permeate society in Brunei Darussalam and the isolation in which teachers throughout the world appear to operate.

Traditions ancient and modern. Teachers in Brunei are immersed in a traditional teaching environment, which influences their attitudes and actions towards introducing changes into their classroom practices. The national ideology of Malay Islamic Monarchy has origins in the 15th Century (Brunei Yearbook, 1999) and the influence of Islam as a religion and a way of life permeates all aspects of daily living, including classroom activities, and strengthens these ancient tenets. As in any society, compliance to accepted norms is expected of participants, and any changes need to comply with M.I.B. ideology. Expatriate teachers from backgrounds that contrast strongly with aspects of Brunei society may have difficulty realising and accepting all of the bounds, especially if there is conflict with their personal beliefs.

Economic prosperity in Brunei Darussalam originates from oil and the influence of money is undeniable. Foreign teachers' retention of their contracts is reliant upon providing satisfactory services, which forms a strong financial incentive to present teaching methods that conform to traditional modes of instruction. Existing teaching and learning approaches are expected and respected by students, parents, colleagues, and educational administrators alike. Replicating these provides a safe means by which teachers retain their contracts but does little to engender the called-for changes.

External examinations are central to many education systems and have been noted elsewhere to limit innovation and inhibit teachers' willingness to explore new teaching strategies (Hargreaves, 1988). A tradition found throughout the world is for teachers to be judged by their students' examination results, a constraint that influences adoption of change (Hargreaves, 1988). The importance of examination

results in Brunei was reflected in a survey of teacher concerns (Wong et al., 1999) that found that improving examination percentage passes had the highest level of concern within items from the category Demands of Teaching. Examination results are central to education in Brunei secondary schools, and the words "teachers ignore the importance of these results at their peril" (Hargreaves, 1988, p. 221) form a truism. While a teacher may believe a teaching and learning activity had an examination focus, the reactions of students may differ, in which case the benefit of the activity may well be lost. Indications of students' reactions towards new activities are important in evaluations of those activities, and this study set about to provide teachers with a viable means to gauge students' reactions.

Isolation and Collaboration

Isolation. Teachers' work environments have been noted as being characterised by isolated practice (Fullan & Hargreaves, 1992). Examinations require an accurately defined curriculum that Fullan and Hargreaves (1992) consider may reduce collaboration, further distancing teachers. The reliance on examinations within the Brunei education system may make teachers particularly prone to being isolated should the 1992 findings of Fullan and Hargreaves also apply to teachers in Brunei.

Hargreaves (1992) suggested that this isolation might not be altogether disliked by teachers as it keeps away intrusions with which they may be uncomfortable. Isolation between teachers limits opportunities for sustained reflection about what they do and increases their dependence on personal experiential knowledge for day-to-day coping, to the exclusion of sources of knowledge beyond their own classroom (Fullan, 1991). Teachers have been noted to rely upon these experiences and reactions in considering the efficacy of classroom practices

(Shymansky & Kyle, 1992a). This study has provided teachers with a means to balance their subjective assessments of activities with reactions from the students.

Theissen (1992) considered that there are three modes of classroom-based teacher development; teacher alone, teacher-teacher, and teacher-students. Teacher alone is the usual and "most enduring mode of teacher development" (p. 92), contributing to the isolated nature of teaching. The instrument that was developed through this study assisted teachers' trials of ideas within their own domains. This may lead on to teacher-teacher development, for when teachers have developed sufficient confidence in both the activity and their colleagues, the now proven activities may be more likely to be passed on to other teachers to face the subsequent external scrutiny. The third of Theissen's three modes of classroom-based teacher development, teacher-students, occurs through obtaining indications from students to support teachers' development and use of activities. This was central to this study, as the SPAID process opened a wider variety of routes for students' communication to teachers than previously existed in normal classroom routines.

Collaboration. Fullan (1991) offers that change cannot be done successfully to others, but works better *with* others. The creation of cultures of collaboration has for a long time been called for to counter the widespread individualism and isolation that are believed to impair many teachers' classroom performances (Hargreaves, 1992). Collegial collaboration has been found in schools that are considered to be successful (Little, 1982) and is believed to be advantageous when introducing changes (Futrell, 1988; Little, 1982), as it encourages teachers to remain focused, motivated, and encouraged (Wildy & Wallace, 1994). Borko et al. (1997) found that the degree of change related to the extent to which the teachers worked together as a learning community. Collaboration, however, does not

necessarily imply reflection or change. Hargreaves (1992) found that collaboration usually involved material sharing and trick trading of an immediate and specific nature and the lack of time available for discussion contributed to keeping the collaboration at a shallow level.

A community in which positives and negatives may be shared without fear of incrimination may enhance benefits from collaboration. Negative reactions can readily be considered indicators of weakness of teachers in Brunei, which may have implications for the remuneration received by them within the contract system by which expatriate teachers are employed. Establishing an appropriate environment for open collaboration may not be an easy task in Brunei government schools, and teachers may wish to keep to themselves the initial reactions of students to activities rather than have them open for display to colleagues and school administrators. Any method of gathering information for this study had to be sufficiently secure for teachers to be willing to gather negative criticisms free from fear of publication. Any further dissemination of results to other parties was then at the discretion of the teacher who initiated the idea.

Teachers in Brunei generally are allocated several classes at the same level and the regular punctuation of the year by common tests and examinations has these classes undertaking similar content concurrently. This situational constraint provides an incentive for teachers who do attempt new activities with students, as time spent in development and preparation can be utilised with several classes. Obtaining appropriate and timely information between successive implementations enabled teachers to improve the usefulness of activities through informed experimentation. However, regular common traditional testing is the primary form of evaluation applicable to both students and teachers in the Brunei education system. These

present immutable progress checks through accurately defined curricula, and markedly dominate the actions of teachers and students alike.

The publication of results can lead to a measure of anxiety which has been noted in comparable situations to encourage conservatism and inhibit willingness to explore new teaching strategies (Fullan & Hargreaves, 1992; Hargreaves, 1988; Joyce et al., 1989). Teachers' attempts to introduce changes to teaching and learning are required to dovetail into existing evaluation schedules. The transparency and close scrutiny of each set of results suggests that any variation from the existing procedures would be small-scale. Consequently, any method developed in this study to aid teachers' estimations of students' reactions to activities had to be able to focus on small changes in practices. Tension for students and teachers in Brunei secondary schools is greatly increased with older students in years of external examinations, and this implied teachers are more likely to attempt variations from traditional activities with younger students in their earlier years of secondary education. This had implications for the level of language used in the instrument within the SPAID package.

Characteristics of Change

The marked lack of successful introduction of educational change must be a concern to those who attempt to introduce the changes. Understanding change appears to be difficult and the development of processes for successful implementation of changes appear to be elusive. Investigation into characteristics of change is an enormous study in itself, and a few observations will now be considered from the perspective of classroom teachers in Brunei.

Classifications of Change

Orders of change. Sarason (1990) has suggested two orders of change. First-order changes work to improve the effectiveness of existing situations without disturbing the basic organisational features and without substantially altering the way that children and adults perform their roles. The majority of changes that teachers made in the 20th century were of this type (Fullan, 1991). Second-order changes seek to alter fundamental ways in which organisations are put together. The structure of educational administration in Brunei Darussalam places second-order changes beyond the conceivable influence of classroom teachers. Consequently, any changes that teachers may consider to their class routines can be expected to be first-order. However, the two orders cannot be expected to operate in mutual isolation. Second-order changes influence what happens in classrooms, and in Brunei they are likely to be promulgated though directives issued by educational administrators. Teachers may then undertake first-order changes to improve the effectiveness of activities that accommodate the changes.

Opportunities for teachers in Brunei to initiate or influence second-order changes are limited. It is difficult to envisage a scenario in which a teacher would set about to influence the structure of educational organisation in government schools of Brunei Darussalam. The scale of the task would be daunting and the reactions of authorities would likely be apprehensive and wary. However, teachers do have considerable influence over the day-to-day actions that occur in classrooms. They may be able to effect very minor second-order changes to the structure of students' approaches to learning, and this was the likely intent of promulgated inspectors' comments given earlier in this chapter.

A single teacher is justified in believing that he or she can not make a difference to the existing educational structure of a nation. However, in Brunei Darussalam the Ministry of Education is diligent in its efforts to improve the education of the nation's youth, and the small scale of the school system in relation to other countries makes the efforts of individual teachers accessible to Ministerial officials. It is not possible to predict outcomes from teachers' small-scale efforts with second-order changes. This study worked to help teachers to improve the value of activities in which they engaged students. These were primarily directed at first-order changes, but they can go a little deeper to impinge on second-order changes that introduce students to alternative approaches to learning.

Dimensions of change. Fullan (1991) considers that there are several components to change and that the effects of this multidimensionality have historically confounded attempts to implement changes. He views that there are at least three dimensions to change. The first dimension includes the use of new or revised teaching material, such as a new text or worksheet. This is the most tangible level for classroom teachers, as they are presented with an item for which they can perceive rapid and relatively distinct outcomes. Teachers can readily accept or reject first-dimensional changes based upon their present knowledge, indicating the expected effectiveness of the changes prior to attempting them with students. In this dimension changes can occur as individual events, either in isolation or in combination with other events or teachers.

The second dimension of change consists of using a new teaching approach. It is at this level that the Brunei Ministry of Education school inspectors called for a wider variety of teaching methods with students (H. B. G. Lim, personal communication, February 1, 1997). The third dimension requires significant

fundamental alterations, including changes in beliefs, pedagogical assumptions, and theories that underlie policies or programmes. Changing teachers' beliefs is particularly problematic as it challenges core values held by individuals regarding the purposes of education (Fullan, 1991).

The three dimensions are not exhaustive, exclusive, or isolated. They interact to varying degrees with the individuals or groups involved and Fullan suggests that implementing change in any one of these dimensions can influence the other dimensions. Real change requires change to occur in practice along all three dimensions. Initiating simultaneous change of this magnitude would be a major task in Brunei and be fraught with difficulties. The interrelationship between the dimensions suggests that a successful implementation at one level will benefit changes in the other dimensions. Positive experiences with a few worksheets in the first dimension that contain new approaches to teaching may encourage a teacher to try more activities that use new ideas. Positive reactions and increased experience at managing these changes may develop confidence to attempt further changes in the second dimension. An example of this is provided in Appendix C in which the students' reactions following their engaging in a new activity led me to an optimistic perspective about using other activities with the class. Positive experiences of this type have the potential to marry changes within classrooms and the calls for educational changes from authorities.

Negative Descriptors

Educational changes over the years have attracted numerous descriptors with negative connotations: uncertain, intangible, complex, erratic, unpredictable, risky, threatening and confusing for teachers, requiring conflict, and prone to disagreement (Fullan, 1991; Fullan & Hargreaves, 1992; Fullan & Miles, 1992; Futrell, 1988;

Hiebert, Wearne, & Taber, 1991; Wallace, 1997). Whilst all of these expressions may be generally disagreeable to teachers in the Western world from where these comments originated, to teachers in Brunei they may be particularly unpalatable.

Teachers in Brunei have few external incentives to adopt changes but several that discourage adopting change. Annual inspection and assessment of teachers' performances together with a traditional society that accepts, expects, and respects existing modes of instruction in schools provide strong incentives for teachers to retain existing modes of teaching and learning. The results of the regular common tests within schools provide one example. These are posted on classroom walls with percentage scores below 50% being marked in red or highlighted in some manner. The importance to teachers in Brunei Darussalam of improving the percentage results of students was noted earlier in this chapter (Wong et al., 1999). Students at all levels undergo regular, common subject tests that provide cumulative indicators of their progress. A factor in teachers' anxiety about change is the fear of being exposed as incompetent (Joyce et al., 1989) and low students' test results would increase the likelihood of this occurring. The importance of Brunei school authorities to classroom teachers is increased through their being instrumental in appraisal decisions that result in the awarding of the annual bonus to individual teachers and renewal of contracts for expatriate teachers. The impressions of school administrators matter to classroom teachers.

A Process that Requires Time, Not an Event

Change has been described as a process, not an event (Hall & Loucks, 1978). It takes time, and is achieved only in stages (Lieberman & Miller, 1981) that do not occur as a rational linear process but rather with uncertainty, hesitancy, and gradualism (Wildy & Wallace, 1994). This gradual unfolding of change can make it

unspectacular (Wallace & Louden, 1992) and the benefits of teachers' efforts to change may take time to come to fruition. Buswick and Inos (1992) suggest staff members may take up to 18 months to incorporate new practices while Borko et al. (1997) claim teachers needed one to two years of intensive work to achieve a reasonable mastery of one process the researchers viewed. Fullan (1991) considered that effective change can be expected to take at least two to three years, during which teachers can expect to experience frustration and discouragement. This frustration and discouragement is fuelled by the *implementation dip*, an initial decrease in performance even in cases where a reform eventually succeeds; a period in which things often go wrong before they go right (Fullan & Miles, 1992).

Regular common tests and examinations in the Brunei education system delineate clear bounds of content within which teachers must operate. Results that students obtain in these periodic assessments are used to appraise any changes that teachers may have introduced. New approaches need to produce results better than existing methods to avoid condemnation by students, administrators, colleagues, and the very teachers who tried the activities.

The time requirement, implementation dip, uncertainty of outcomes, and close scrutiny of results from periodic common tests and examinations combine to limit teachers' enthusiastic involvement in significant changes within normal classroom practice. Consequently, teachers in Brunei who do attempt new ideas can be expected to be cautiously eclectic in their selection of any changes that they do attempt on their own initiative.

Conflict and Risk

Conflict and disagreement are considered fundamental to successful change (Fullan, 1991), but the thought of inciting any conflict would be anathema to Brunei

traditions of peace and stability. The official name of the country, Brunei Darussalam, meaning "Brunei, the abode of peace" (Brunei Yearbook, 1999, p. 30) is the antithesis to the concept of conflict, and inciting activities that generate disharmony at any level may be viewed unfavourably by authorities. The strength of this barrier to teachers implementing new ideas in their praxes may be difficult to gauge and difficult for expatriate teachers of Western orientation to understand.

Students are likely to be doubtful and wary of any new teaching ideas that conflict with time-honoured practices. The outcomes of established approaches are predictable whilst those of new ideas are unknown, so teachers take risks and experience some concerns when using new ideas (Fullan, 1991). This risk factor for teachers in Brunei can touch the annual appraisals that may have service and financial consequences. Through avoiding conflict at any level, teachers ensure their rewards of full annual bonuses and continued employment. These provide convincing arguments that encourage teachers to ignore calls for change.

For teachers to adopt the calls for changes in their approaches to teaching and learning they will need to achieve a balance between conflict and security. If there is too much conflict then teachers may retrench in their receptivity of change attempts. If there is too much security, too little will be achieved. A suitable aim would be to generate sufficient conflict for a change to occur, and to resolve that conflict satisfactorily before it could become a concern. The delay in observing academic improvement referred to as the implementation dip suggests that benefits might take too long to develop to be appreciated by students. This indicated that a means other than written content tests was needed to provide teachers with information pertinent to the influence of new teaching ideas on the learning of students. It was the intention

of this study to begin searching for a means to obtain such information in a manner that was viable for classroom teachers in Brunei Darussalam government schools.

Cognitive conflict. The use of situations that require the resolution of cognitive conflict is considered necessary for conceptual growth (Duit & Confrey, 1996; Jones, 1995), however, their use is fraught with complexities, many of which are magnified for foreign teachers in Brunei who may attempt to introduce students to cognitive conflict situations. Teachers need to identify, create, and manage appropriate cognitive conflict situations to enhance students' understanding of content. Managing such situations needs great care, as any lingering doubt in a student may lead to recalcitrant or obdurate reactions to further attempts. The credibility of the teachers would then come under question with the potential to influence their financial returns and service conditions.

Teachers generally prefer familiar procedures, "personal comfort, routine practices, classroom order" (Wallace & Louden, 1992, p. 513), so it is understandable when teachers in Brunei prefer to avoid establishing any form of cognitive conflict or doubt in students. Questions arise for those teachers who do contradict norms by attempting new ideas to improve the efficiency of their teaching. How can a teacher obtain knowledge of the levels of conflict generated in students through a new activity? How will they know if that conflict has been resolved? This study provided teachers with one safe means by which to gauge students' reactions to the activities, advantageously soon after using the activity so as to minimise any damage done should those reactions be negative.

Suggestions for Successful Change Implementation

Considerable effort has been expended in this chapter on identifying the difficulties that might influence teachers' adoption of called-for changes in approaches to teaching classes in government schools in Brunei Darussalam each day. Attention now turns to considering suggestions in literature that may enhance teachers' attempts to inculcate changes into their teaching practices. Comments in literature tend towards general guidelines and these will be considered as they apply specifically to students and teachers in Brunei. These guidelines established a framework for this study as it provided classroom teachers with a practical and viable means to improve the impact of new activities they try with classes of students. One general indication noted by Roth (1998) is that "when reforms (including changes in classroom environments) emerge from the grass roots at the classroom or school levels, and are therefore grounded in the experiences of practitioners, they appear to be more successful and lasting" (p. 75).

Relevance, Readiness, and Resources

Fullan (1991) has suggested that teachers' adoption of changes require three components; relevance, readiness, and resources. Relevance refers to teachers' recognising the preference for the changes. The change should address a need that is important to the teacher (Futrell, 1988). Teachers who participate in this study had already established belief in the relevance of the new ideas they employed with students. Readiness refers to the teachers' capacity to use the reform, being willing to try new ideas and being receptive to adaptations (Firestone, 1989). Teachers participated in this study only if they were sufficiently interested in the outcomes to consider potential changes to activities in which they engaged students.

Resources to engage new activities or new approaches to teaching and learning need not cost money, although Brunei Darussalam government school administrators are willing to support teacher initiatives within their allocated budgets. The calls for change in Brunei by Tairab and Salleh (1997) and the school inspection report comments passed on to teachers (H. B. G. Lim, personal communication, February 1, 1997) required little in the way of money to resource. The trigonometrical activity outlined in Appendix C of this study used equipment that had been purchased by the school. However, I had used the same activity at another school that did not have the equipment. In this case students constructed their own clinometers to measure elevations by taping drinking straws and string onto their own protractors, and the distances from the base of the object were measured by using 20-metre lengths of string with coloured thread tied every 5 metres. The resources were available at minimal cost, though a little invention was required.

Nelson and Sieber as far back as 1976 commented that the monetary cost of changes was inversely related to the quality of the change, but this view may be unlikely to find favour today among proponents of technology. Regardless, school classrooms and systems can and do improve, and the factors facilitating improvements are not too exotic, unusual, or expensive to be beyond the reach of ordinary schools (Clark, Lotto, & Astuto, 1984). The real resource cost of innovations comes from the extra time and energy required of teachers, adding significantly to their workloads. This was the case with my earlier attempts with the trigonometrical activity; however, the costs were worthwhile since I believed there to be sufficient relevance of content in the activity and I was ready to challenge myself to learn from introducing a new activity into my repertoire.

Enacting changes can be difficult for participants and should teachers be willing to attempt new ideas, they deserve realistic support to do so. Within the Brunei-based calls for changes are suggestions to use "a broader range of teaching and learning strategies…to meet the needs of the wide ability range" (H. B. G. Lim, personal communication, February 1, 1997). This requires knowledge and experience of various approaches as they apply in different classroom situations with differing cohorts of students. Teachers' personal opinions are the primary means by which they assess classroom activities, and they may find useful a resource that accesses other reactions to activities in order to complement their personal perspectives.

Support and Security

Support. Discussions about educational change include references to the need to provide teachers with support and guidance in safe climates that are tolerant of experimentation, imperfect implementations, and conflicting opinions (Borko et al., 1997; Buswick & Inos, 1992; Fullan, 1991; Fullan & Miles, 1992; Futrell, 1988; Jones, 1995; Wallace, 1997). This support must neither forget nor ignore the affective and moral domains (Crandall, Eiseman, & Louis, 1986). The example from Brunei of a call for change cited earlier in this chapter that went directly to teachers (H. B. G. Lim, personal communication, February 1, 1997) originated from a team of inspectors following their two-week visit to a school. Once made, the called-for changes were required to stand alone without support or assistance to the teachers who might, or might not, implement the changes. Without realistic support there is considerable danger that such well-intended and researched calls for change remain as fine words that impress fellow administrators but fail to make an impression on the daily actions of teachers and students.

Security. Adopting the educational changes called for would require countering some established norms within the Brunei educational community. Toleration of attempts to broach boundaries of accepted practices can vary in Brunei society. Some are taboo and nonnegotiable, such as the components of the M.I.B. ideology (Brunei Yearbook, 1999). Differences between acceptable and unacceptable challenging of other conventions on some occasions can be unclear and subjective. Should teachers invoke displeasure in students, parents, colleagues, or education administrators, then their suitability for employment might be called into question, with potential ramifications for the individuals, such as transfer to another school, nonrenewal of contract, or reduction of yearly bonus.

The simplest and easiest approach for teachers is to avoid any change that does not carry a compulsory mandate, thereby abdicating responsibility and being immune to consequences. While this may appear extreme, teachers are entitled to be guarded in their adherence to change attempts when their employment may be at risk. No teacher purposely sets out to offend students and any transgressions that do occur originate from good intentions. Having engaged a class in an inappropriate activity the teacher cannot undo the event. Adventurous teachers can benefit from the SPAID process developed thorough this study: it provides a secure means by which they can rapidly find out that a well-intended task was not suitable. They may then attempt reparations with that group of students and avoid replication of errors with other classes.

Use Existing Skills

The talent of teaching lies in the compilation and application of professional knowledge that is amassed and sorted though years of experience and hard work. Wallace and Louden (1992) suggest this talent should be utilised within attempts to

change teaching and learning. Rather than attempting to replace knowledge, changes ought to build upon the existing wisdom and expertise of teachers (Wildy & Wallace, 1994). This study provided classroom teachers with a viable means to ease the assimilation of new information into their existing repertoires, cognisant of factors important to them.

Change may be facilitated through key personnel introducing new ideas based upon teachers' current levels of interest, understanding, and skill (Borko et al., 1997). Theissen (1992) advocated greater teacher autonomy by moving towards teachers defining their own development, with staff developers providing support to their efforts, rather than attempting to change teachers via inservice training, which he suggested some teachers choose to ignore, selectively coopt into existing practices, or even subvert. There are plenty of opportunities for teachers in Brunei government secondary schools to attend various training sessions, a number of which they are directed by school authorities to attend. The opportunities are there and it is how the teachers assimilate the new ideas into their existing practices that measures the effect of the sessions.

Goldenburg and Gallimore (1991) encourage teachers to engage in a rigorous examination of their teaching, consisting of concrete challenges and a range of possible solutions, stipulating that these events must be grounded in daily and repetitive routines of teachers' daily work lives (p. 69). This suggests situating change processes in classrooms as these are the teaching and learning contexts in which the ideas are to be implemented (Borko et al., 1997). Central to this study was the concept of teachers developing a tool for use by teachers who could use it for the benefit of their own teaching with their own classes of students. Any use of a new teaching and learning idea would require close examination as to whether progress

was being made, and teachers deserve a means of support for their introspection of attempts. The outcomes of these decisions may be pivotal in their further use of new ideas.

Selective, Small-Scale Attempts

Some pertinent suggestions for adopting changes in schools that apply to attempts by teachers in Brunei Darussalam come from Fullan and Hargreaves (1992). They suggest three general criteria for beginning to practise risk-taking: be selective, attempt something on a small scale, and take positive steps by trying something rather than refuse to try something. Previous sections in this chapter have indicated barriers to the adoption of new approaches in the teaching and learning activities in which classroom Brunei government secondary school teachers engage students. Undertaking small-scale changes opens opportunities to ultimately surmount these difficulties. High levels of ownership of the activities accompany teachers' decisions to try the ideas, and the trials of the activities they choose then augment teachers' existing skills and beliefs. Importantly, teachers retain direct control over the implementation and further development of the activities with classes. The development of activities would be occurring primarily for the benefit of the teachers and the students.

Trials of new activities ought to be sufficiently small in scale so that, should an uncomfortable level of conflict arise, the teaching can be repeated in a more traditional manner to placate concerns without undue interruption to progress through the required curriculum. For this to occur would require a practical means by which teachers could obtain early warning of discontent for small-scale activities, a need this study set out to fill. The information may also be useful in decisions about developing the activity further for use with other cohorts of students.

Tinkering. There appear to be advantages in teachers tinkering with the teaching and learning ideas in which Brunei government secondary school classroom teachers engage students. Fullan (1991) suggested that teachers have little interest in major policy decisions, being more concerned with the day-to-day matters they encounter. Such an approach is sensible for foreign teachers in Brunei. Their personal opinions have minimal impact on national policies so any developmental interest is likely to be directed within their own classrooms where they can have an influence. Teachers need "the freedom to tinker with new curriculum possibilities at their own comfort levels, which need to coexist with other demands" (Wildy & Wallace, 1994, p. 73).

Tinkering with teaching ideas can have immediate dividends in Brunei government secondary schools as teachers are usually allocated multiple classes of the same level which are undertaking concurrent content. Obtaining appropriate and timely information between successive implementations of the same activity would enable teachers to improve the efficacy of that activity through informed experimentation. This is considered a powerful way to develop crucial ownership in teachers (Goldenburg & Gallimore, 1991; Huberman, 1992; Wallace et al., 1995; Wildy & Wallace, 1994) as well as being helpful in developing teacher satisfaction (Huberman, 1992).

Ownership. Teachers' ownership of ideas is considered important if they are to be included in educational changes. Wallace et al. (1995) found teachers with more independent and autonomous approaches to teaching were more committed and innovative than those who merely "operated as a conduit for change" (p. 48). Tinkering and practising with activities is considered a powerful way of developing ownership (Wallace et al., 1995). Huberman (1992) noted that teachers who had an

early concern for instructional efficiency and who tinkered with small changes were more likely to be satisfied later in their teaching careers.

It is important to view the development of each teacher as an ongoing process (Jones, 1995). Tinkering with new ideas should be a common occurrence and assessing the impact of these small changes is important. However, there is a warning that teachers can become too committed to trials of new ideas. "Heavy involvement in school-wide innovation was a fairly strong predictor of 'disenchantment' after about 20 or 25 years of teaching…although the [involvement] is perceived as stimulating and enriching while it is happening" (Huberman, 1992, p. 131). Striking a satisfactory balance would require a means to obtain regular indicators of the effects of their tinkering as the teachers develop various activities to suit varying cohorts of students.

Summarising Directions for Assisting Change

This study focused on developing a means to support individual classroom teachers in Brunei Darussalam government schools to improve the new teaching and learning ideas that they instigate with students. Indications from literature suggest many advantages for the activities themselves to come from the teachers. The professional development is initiated by the teacher who uses the activity with students (Raymond et al., 1992) and originates from a particular need identified by the same teacher (Huberman, 1992). Initiation has origins at the local level of the practising teachers, rather than more distant policymakers (Deal, 1990). For teachers in this study to have expended, of their own volition, the effort to engage students in the activities also suggests that they considered there to have been sufficient relevance, readiness, and resources available (Fullan, 1991) to warrant inclusion of

the activities in their existing repertoires (Wildy & Wallace, 1994). The task of this study was to help teachers to improve the value of the activities.

Teachers were expected to be selective in their use of small-scale activities, which itself was positive as they tried new ideas rather than refused to try something (Fullan & Hargreaves, 1992). As teachers initiated the activities, the balance between the level of conflict necessary for change to occur (Fullan, 1991) and the security required for teachers to be willing to engage new ideas (Borko et al., 1997) was expected to be comfortable for the teachers. Through initiating the activities with students, the teachers increased their ownership of the tasks, considered crucial to teachers' adoption of new ideas (Wallace et al., 1995).

Further tinkering with activities by individual teachers through informed experimentation to adapt them to the differing cohorts of students further increases their ownership of the events. "It is through informed experimentation, pursuing promising directions, and refining practices that most headway will be made" (Wallace, 1997, p. 10). Teachers will always need to assess their initial efforts with new ideas with classes, and to answer the important question *Was it worth it?* (Fullan, 1991; Theissen, 1992). The regularity with which new ideas can occur to thinking classroom teachers suggests that they may benefit from a rapid means of assessing their tinkering in a manner that has limited interference upon daily routines. Attention can then move from repeating the calls for teachers to attempt changes to assisting their efforts as they adopt the called-for changes in classroom practices.

Students

A factor yet to be introduced into this discussion on instigating educational changes is the role of the students. Teachers may make decisions about whether

changes will be implemented in classrooms, but the final test for the worth of any change surely rests with the students upon whom the changes are applied. "Students' motivation and understanding regarding a change are directly related to whether and how they engage in what we might call implementation activities, which are the means to achieving the learning outcomes in question" (Fullan, 1991, p. 189).

The prescribed Learning Aims of the O-Level examination sat by all Form 5 secondary school students in Brunei include the words "…derive satisfaction, enjoyment…" (University of Cambridge Local Examination Syndicate, 1999b, p. 4). Different perspectives of students and teachers towards activities can influence their respective reactions to those activities. Gervasoni (1994) found that students with English as a second language were less likely than native-English-speaking students to perceive the teacher making mathematics lessons enjoyable and fun as being helpful. Consequently, teachers in Brunei who engage students in teaching and learning activities that promote enjoyment may find they have significantly less impact on students' opinions than they expected. Knowledge of such differences would enable teachers to modify activities. This study set about to open avenues by which teachers could become more informed of these differences.

Attention therefore turns to what research literature has to say about students' reactions to educational endeavours. Reflecting upon actions which students believe to be useful in assisting learning enables teachers to select teaching strategies for their students from a more informed position (Gervasoni, 1994). Obtaining information regarding the perceptions of students may be potent if teachers are to evaluate those activities. Differences between the perceptions of students and teachers may provide indications of directions for modifying the activities to enhance

their impact, as well as identifying circumstances when one activity may be preferred over others.

Students' perceptions. Research into school and classroom climates has blossomed over the last thirty years. The year 1998 saw the launch of *Learning Environments Research: An International Journal* (Fraser, 1998b), testifying to the wealth of research that continues to occur. Environmental variables impact on human behaviour in a wide variety of ways and the influence of psychosocial variables such as self-esteem, personal growth, and intellectual development, have been found to be powerful in a variety of settings, including education (Rentoul & Fraser, 1979).

Indications from literature suggest that teachers in Brunei who attempt changes in their approaches to teaching are likely to benefit through the use of activities that are small in scale. Monitoring the process of change is just as important as measuring outcomes (Fullan, 1991). Some instructional procedures may be better for some students and less good for others (Kempa, 1997), so there will also be a need to identify the existence of students for whom a particular activity may be more effective than another approach. To do so, teachers need a means by which they can obtain indications of students' reactions to these activities and use them to benefit their adaptations of the activities with other groups of students. It was the aim of this study to provide classroom teachers with a viable means to access such information.

The remainder of this chapter focuses on considerations when obtaining student perception data and the options for establishing an instrument to aid teachers in government schools in Brunei Darussalam to evaluate activities in which they engage students.

Considerations for Obtaining Data

Several factors have evolved over the years when gathering data from educational environments and a number of these are shown in Figure 1, each as a bifurcation. This section outlines these factors and identifies elements that needed cognisance in this study to establish an instrument suitable for providing teachers with appropriate data. Fuller descriptions follow, but a sketch of the pathway taken in this study illustrates the use of Figure 1. Having decided to embark on a study of an educational environment, I chose to seek reactions directly from the students and teachers who were fully immersed in the schools and classes that were subject to this study (*beta press*) rather than obtaining information through a detached observer (*alpha press*). My next decision was to seek students' personal and private impressions of activities rather than their estimations of the consensus of views for the class. Then came the judgement to look at items that focus on the classroom rather than at the more general school level. A major development in the use of educational environment instruments has been the comparison of students' perceptions of their ideal educational environment with that which they perceive actually exists. For this study I centred on students' views of their actual situation, and the final decision was to use a short instrument with the adherent limitations of brevity, rather than a long and perhaps more rigorous version.

The aim was to provide teachers with a means by which they can improve the effect of the activities in which they engage students within their normal day-to-day routines. Crucial throughout the study were the realities of classrooms as perceived by the teachers as well as teachers' perceptions of their own roles within the government educational system of Brunei Darussalam.

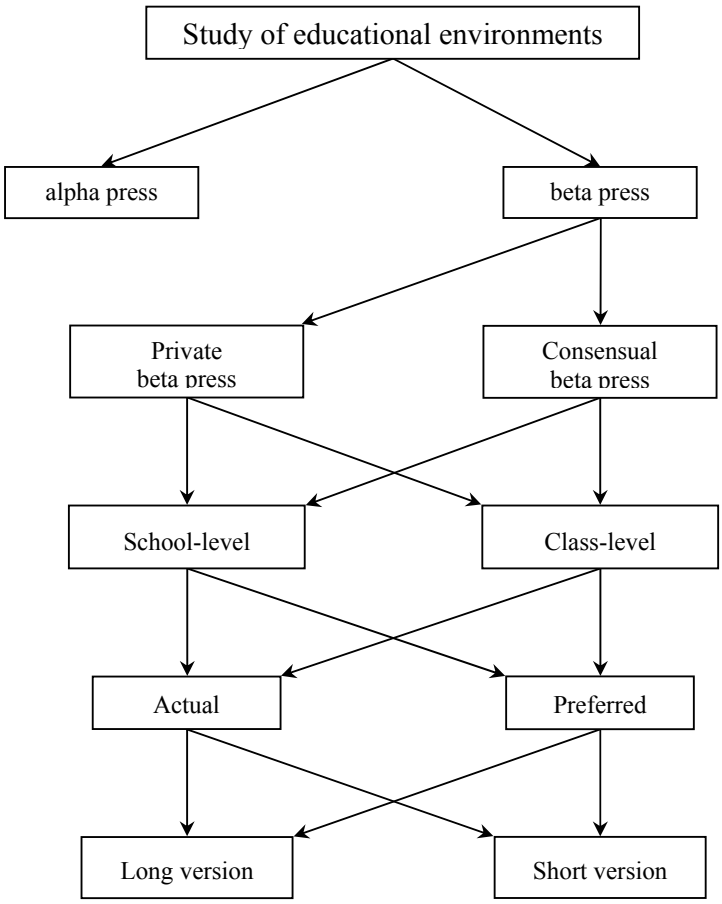


Figure 1. Considerations when establishing a means to obtain information about educational environments.

Alpha Press and Beta Press: Detached Observer vs. Participants' Perceptions

Two contrasting methods of gathering information about educational environments were termed *alpha press* and *beta press* by Murray in 1938. Alpha press refers to assessment by a detached observer while beta press is based upon the description of the environment as perceived by the occupants of that environment. Fulltime teaching loads of teachers leave little, if any, time for them to observe the actions of other teachers or even their own students in detail. Methods that obtain

information of students' perceptions therefore need to provide teachers with data that can be considered outside the time-pressured period of class contact.

Video recorders are useful research tools and can provide opportunities to review events at a later time devoid of the continual interruptions that invade classroom operations. The evidence could also be presented to another teacher for consideration, thereby gaining a degree of alpha press information. Several considerations conspired against video recording of activities in this study. First, the absence of video recorders within schools suggested that their use would have introduced too high a level of intrusion into usual classroom routines. As a consequence of previous efforts to obtain responses from students (Nannestad, 1997), strict anonymity of students' responses was invoked throughout this study to enhance the validity of students' responses. Video recording of students' reactions would have removed this anonymity and nullified teachers' confidence in the results. This study looked to provide teachers with a viable means of obtaining student perception data. Requisite cost and time to obtain and set up equipment, view the recordings, and then deliberate upon observations would have been beyond that which teachers were likely to consider acceptable. In addition, the lack of many teachers' proficiency in a language in common with the majority of students would have required further translations and interpretations of the spoken communications between students.

The vast scope of data available through video recordings would have presented difficulties by distracting the teacher from the original purposes of the activities. Consequently, logistic issues relating to establishing a means by which teachers can gather, process, and then consider data combined to suggest that the use of alpha press methods would have been inappropriate in this study.

Advantages of beta press. There is strong support for using the beta press perceptions of those directly involved in the environment, requiring what Rosenshine (1970) referred to as high-inference measures that involve a judgement about the meaning of classroom events. As well as being more economical, covering greater periods of time and number of students' responses, these methods have been found to account for considerably more variance in student learning outcomes than directly observed outcomes noted by detached, outside observers (Fraser, 1994; Fraser & Fisher, 1983a). Further evidence that external, specially trained observers returned results equivalent to students' ratings and student achievement (Marsh, 1983) supports the description of beta press methods as "parsimonious" (Trickett & Moos, 1973, p. 94).

This study looked to support teachers' efforts to improve the effectiveness of teaching and learning activities within the bounds of their normal teaching activities. A further advantage for employing beta-press methods is that they provide a ready vehicle by which teachers may take leading roles in research, reducing the gaps between researchers and teachers noted earlier in this chapter. Teachers here were the instigators of the activities, the evaluators of information, and their own students were the beneficiaries.

Level of Analysis: Private and Consensual

In 1956 Stern, Stein, and Bloom further classified beta press perceptions of environments into two levels of analysis (Fraser, 1989b; Fraser, Fisher, & McRobbie, 1996). Reactions of individuals as they relate to their own private and idiosyncratic perceptions were labelled *private beta press* while the individual's perception of the reactions of the group as a whole were labelled *consensual beta press* (Fraser et al., 1996). Instances where such a distinction may alter responses can be readily noted in

instruments such as the *Learning Environment Inventory* (LEI) (Fraser & Fisher, 1983a). Responses to Item 9 of the LEI, *The work of the class is difficult*, may differ if considered on a personal basis (how difficult I find the work) or as a consensus (how difficult I believe the students generally in the class find the work). The ability for such considerations to influence results has been noted by Fraser and Fisher (1994) who indicated the need for instruments that differentiate between the perceptions of private and consensual responses.

Emphasising responses as either private beta press or consensual beta press has led to establishing variations of the same instrument. Fraser, Fisher, and McRobbie (1996) established a Personal Form and a Class Form of the *Science Laboratory Environment Inventory* (SLEI) and suggested that they measure different but overlapping aspects of a classroom learning environment. Information indicated that students had a more positive view in some scales when they responded in relation to the whole class than when they gave their perceptions of their personal role in the classroom environment (Fraser et al., 1996).

School-Level and Class-Level

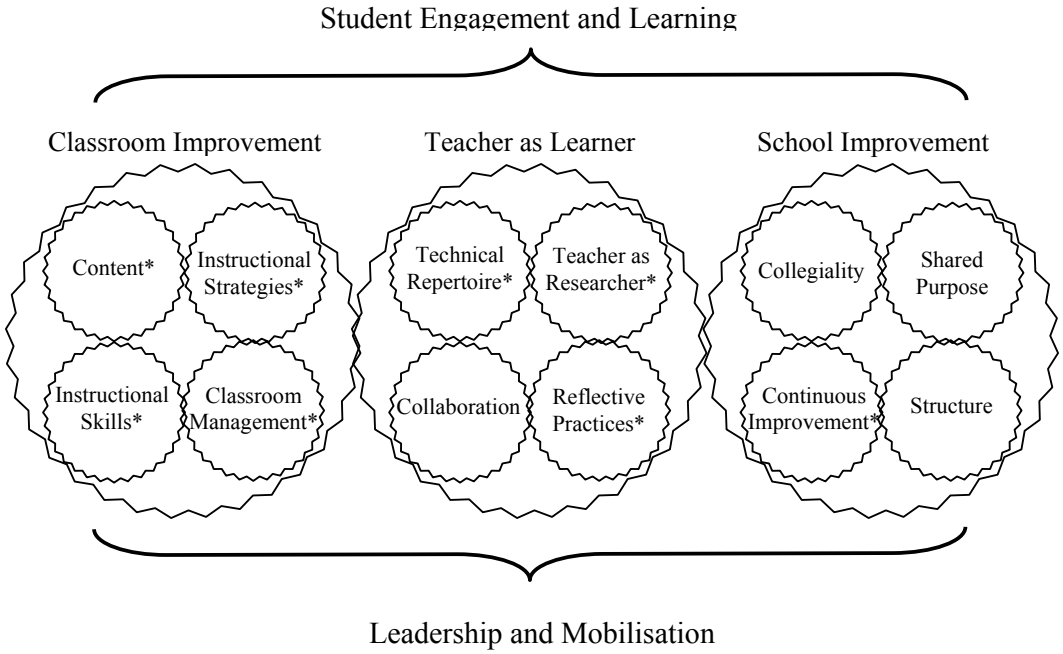
Investigations into educational environments through the use of psychosocial instruments have developed distinctions between those that focus at the school level and those that focus at the classroom level. These have traditionally remained independent of each other (Dorman, Fraser, & McRobbie, 1995), which may be a result of their historical origins and differences in their theoretical foundations (Docker, Fraser, & Fisher, 1989). School-level interests have links with the field of educational administration and have emanated from work on organisational climates in business contexts (Fraser, 1986, 1989b). Perceptions of these tend to be measured via the perceptions and interactions of teachers (Docker et al., 1989; Fraser 1994).

Classroom environment research, on the other hand, has origins in psychiatric hospitals and correctional institutions (Docker et al., 1989; Fraser 1994). Here has developed a tradition of linking students' perceptions of their classroom environments with student outcomes of factual and higher level cognitive understanding and affective nature (McRobbie & Fraser, 1993). Perceptions at the classroom level are usually obtained from students and their teachers, and have been attributed with appreciable amounts of variance in learning outcomes (Fisher & Fraser, 1983a,b; Haertel, Walberg, & Haertel, 1981; Walberg et al., 1979; Wubbels, 1993).

School level linked to classroom level – weakly. There is a generally accepted view that a good school environment enhances student outcomes (Dorman et al., 1995), though there are indications that the link between classroom environments and student outcomes may be stronger and more direct than between school environments and student outcomes (Dorman et al., 1995; Fraser & Fisher, 1994). As the primary effect of teaching occurs at class level rather than school level, it could be argued that investigation of teaching strategies should concentrate at the class level. Nonetheless, the combining of school level and classroom level investigations is considered a positive direction (Fraser, 1994) and it would have been shortsighted in this study to have ignored school level instruments as they may have contained relevant scales.

Teacher as learner. Interest in the link between classroom and school improvement led Fullan, Bennett, and Rolheiser-Bennett (1990) to develop a framework that connects the two by considering the teachers as learners (Figure 2). Central is the idea of teachers being quintessential to the instigation of changes in classrooms (Fullan, 1991; Fullan & Hargreaves, 1992; Koehler & Grouws, 1992;

Wallace, 1997; Wildy & Wallace, 1994). This was attractive to this study as it readily relates to teachers attempting changes in teaching and learning activities with students, and learning from these attempts to improve the new activities. Fullan et al. originally presented a system of engaging cogs, which the authors agreed is misleading as complexities of classroom and school improvements preclude such simple imagery. Teaching is not mechanistic and movement in one cog does not necessitate movement in another. However, Fullan et al. did consider movement is important, and Figure 2 has been reproduced here using representations of frictional wheels rather than cogs.



* Indicates areas this study aimed to assist.

Figure 2. Comprehensive framework for classroom and school improvement. (Fullan, Bennett, & Rolheiser-Bennett, 1990, p.15.)

The framework consists of three larger wheels representing Classroom Improvement, Teacher as Learner, and School Improvement. Each larger wheel contains four smaller component wheels. Classroom Improvement contains Content, Instructional Strategies, Classroom Management, and Instructional Skills. This study aimed to benefit all four of these components.

Three of the four components within the central Teacher as Learner wheel benefited from this study; Technical Repertoire, Teacher as Researcher, and Reflective Practices. The fourth, Collaboration, was viewed as a possible benefactor of the increased interest in teachers altering their classroom practices. The finding of Fullan et al. (1990) that concentration on one of the four aspects within the Teacher as Learner wheel had consequences in the other three wheels supports this.

Continuous Improvement was the component in the third large wheel of School Improvement that was most directly influenced by this study. However the interactions between all the components suggest that the other three components of Collegiality, Shared Purpose, and Structure may also have been influenced.

Actual (Real) and Preferred (Ideal) Versions: Iteration of the Teaching Cycle

A further bifurcation in the assessing of psychosocial environments through the use of instruments is to compare data for the actual or real environment against that of the preferred or ideal environment as perceived by teachers and students (Fraser & Fisher, 1983e). This is achieved by administering two similar versions of the same instrument. Two instruments for which actual and preferred versions have been established are the Individualised Classroom Environment Questionnaire (ICEQ) (Fraser & Fisher, 1983a) and the Science Laboratory Environment Inventory (SLEI) (Fraser et al., 1992). Directions for the SLEI illustrate the difference between the two versions. The Actual Form has the direction

> This questionnaire contains statements about practices which could take place in this laboratory class. You will be asked **how often** each practice **actually takes place**. (Supplement A)

The corresponding direction for the Preferred Form is

> This questionnaire contains statements about practices which could take place in this laboratory class. You will be asked **how often** you would **prefer** each practice to take place. (Supplement B)

Person-environment fit. The use of actual and preferred versions has origins in Stern's 1970 theory of person-environment congruence in which complementary combinations of personal needs and environmental press enhance students' outcomes (cited in Fraser & Fisher, 1983d). Research into the matching of person-environment fit has shown that students achieve better where there is a greater congruence between the actual classroom environment and that preferred by students (Fisher & Fraser, 1983a; Fraser & Fisher, 1983c,d; Fraser & Rentoul, 1980). A direct application to daily teaching and learning is for teachers to use students' perceptions to guide attempts to improve classrooms (Fraser, 1981c). Fisher and Fraser (1983a) speculated that this matching may be as important as the programme or innovation in determining student achievement and attitudes. If this is to occur, then teachers need to obtain information regarding their students' perceptions towards an activity to help judge the benefit of that activity. This study sought to provide teachers with a ready and viable means to access students' reactions.

Comparison using actual and preferred instruments. Investigations into the differences between actual and preferred perceptions of environments by Fraser and others (Fisher & Fraser, 1983a,b; Fraser, 1982b, 1984; Fraser et al., 1992; Fraser & O'Brien, 1985; Fraser & Rentoul, 1980; Wubbels, Brekelmans, &

Hoomayers, 1991) have indicated that students' preferred classroom environments are consistently more positive than the environment perceived to be actually present and that teachers tend to view classroom environments more positively than their students. Wubbels (1993) noted that the age of the students appears to influence their preferences, with younger students in the Netherlands preferring tight teacher control and older students preferring to retain more responsibility. There may be implications for teachers' use of various teaching styles if these differences are paralleled in the classrooms of government schools in Brunei Darussalam. Knowledge of students' reactions to various teaching and learning activities made available through the SPAID package may provide teachers with a clearer appreciation of these preferences than their personal subjective assessments supply.

Exemplary teachers. Study into characteristics associated with teachers who were acknowledged as being exemplary identified their having class environments where the differences between actual and preferred environments as perceived by students are closer than those for other teachers and other comparison groups (Fraser & Tobin, 1989b). Porter and Brophy (1988) provide a number of features of effective teachers, including clarifying the intent of the activities, developing knowledge of the students, and monitoring students' understanding through regular and appropriate feedback. Many of these applied directly to this study, which looked to assist teachers to improve the usefulness of activities that they introduce to their students. Knowledge of students' reactions to specific activities could provide teachers with insights into alterations of routines that may enhance the listed features of effective teachers. Whether teachers who would otherwise be excluded from the labels of *exemplary* or *effective* could then develop to be considered as such through adopting these features provides an interesting question beyond this study. Regardless,

teachers and students are likely to benefit through teachers' greater involvement in developing activities.

Iterative cycle. Equipping teachers with information pertaining to students' actual and preferred perceptions of classroom environments provides opportunities to modify activities to reduce the disparities between the two sets of responses, thereby improving the person-environment fit. Following modifications, teachers could then obtain a new set of actual/preferred responses and iterate the process, presenting a framework for continuous research studies. However, this study is aimed at teachers who are engaged fulltime in classroom teaching where realities can conflict with ideals. The time requirement to administer and process both actual and preferred versions of the same instrument was expected to be too long for teachers to adopt this procedure within their normal routines. Items in existing instruments (Appendix B) tend to focus on general classroom processes rather than particular activities. There is considerable merit in developing a tool to support teachers through an iterative cycling of measurement, reflection, and considered change, that can be applied to small-scale specific activities.

Long and Short Versions

Calls by teachers and researchers for more rapid and economical methods of assessing classroom environments than through administering full versions of instruments (Fraser, 1982a; Fraser & Fisher, 1983b, 1986; Fraser & Tobin, 1989b) led to the development of several short forms of standard instruments. These include the Individualised Classroom Environment Questionnaire (ICEQ), the *My Class Inventory* (MCI), and the *Classroom Environment Scale* (CES) (Fraser & Fisher, 1983b). Adaptations include reducing the number of items to approximately 25,

designing forms to facilitate hand scoring, and averaging the perceptions of students to obtain class means (Fraser & Fisher, 1983b).

This study aimed to encourage teachers to implement various teaching and learning activities over a period of time through the repeated administration of the same instrument to different cohorts of students, or to the same cohort of students for each of several activities. The desire to minimise intrusion into daily activities amplified the need for efficient administration and processing of responses. Any instrument that classroom teachers would use willingly and repeatedly must benefit from brevity for students and teacher alike. However, reduction in the size of the instrument would increase the superficiality of data. Nonetheless it was considered preferable in this study to establish a very short instrument that teachers might be willing to use rather than offering an instrument of greater depth that could require time in excess of what teachers may be willing to expend.

Teachers and researchers have available a battery of instruments (such as those in Appendix B) and their mutations that can include using versions on a personal or consensus level, actual or preferred versions, and long or short forms. This study focused on obtaining indications from individual students in everyday teaching situations so preferred instruments that obtain data of individuals' personal reactions to the actual events through as short a means as possible.

Hybridisation of Instruments

Considerable expertise has been expended over the years establishing instruments to obtain indications of students' perceptions towards their educational environments. The preferable situation for this study was to utilise one of these existing instruments, thereby expanding the cultural diversity of accumulated research. This would only have been appropriate should the scales or domains

measured by existing instruments have dovetailed into the interests of classroom teachers. Fields of interest of educational environments are ever widening, presenting many opportunities for researchers but considerable difficulties for existing instruments to cater for these needs. Several methods have been used to adapt existing instruments in order to match this expansion, creating a burgeoning number of instrument variations. These methods were considered when assessing existing instruments for use within this study.

Cosmetic alterations. Wong and Fraser (1994) utilised the SLEI and *Test of Science Related Attitudes* (TOSRA) as foundations for parallel instruments focusing on chemistry. Their *Chemistry Laboratory Environment Inventory* (CLEI) was formed by a cosmetic alteration through "replacing the word 'science' with 'chemistry' throughout. The rest of the wording remained unchanged" (p. 54). Actual and preferred forms of the SLEI have been established and these were continued with the CLEI. Teacher versions were also formed through rewording the items to reflect a teacher's perspective.

Truncation. The *Questionnaire of Chemistry-Related Attitudes* (QOCRA) used by Wong and Fraser (1994) is a truncated version of the TOSRA. Three out of the original seven TOSRA scales were considered and the cosmetic change to wording (science to chemistry) also included. The truncating of an existing instrument appealed in this study as the expected repeated use of the instrument with students suggested that teachers were likely to consider full versions of existing instruments too lengthy, hence inappropriate.

Synthesis of instruments: mix and match. The scope of educational investigations is continually expanding, requiring further modifications of existing instruments. One method used by researchers is to extract scales from within existing

instruments, to be synthesised to form new instruments for specific investigations. The *Geography Classroom Environment Inventory* (Teh & Fraser, 1993) contains scales adapted from the ICEQ, CES, and SLEI. When Fraser et al. (1996) constructed the instrument *What is Happening in this Class* (WIHIC) they attempted to synthesise scales that had been found to be significant predictors of outcomes. Dorman, Fraser, and McRobbie (1997) modified scales from the LEI, CES, CUCEI, and ICEQ in order to investigate classroom environments in Catholic schools. Similar synthesis was investigated to accommodate the specific interests of this study.

Variation plethora: researcher's utopia, teacher's nightmare. The proliferation of instrument variations presents researchers with exciting possibilities. A series of variations of one instrument is possible, including versions for teachers and students, measuring perceptions at personal and class levels of their actual and preferred classrooms. To obtain indications of the influence of a new activity upon students these instruments could be administered before and after each use of each activity.

Realities for classroom teachers present a different view. The provision of such a plethora of instruments is likely to detract from, rather than encourage, teachers' interest in environmental instruments. To obtain and retain the interest of even enthusiastic teachers in the use of instruments to help them to improve the potency of activities with students, the process needed to fit around the immediate and daily pressures of teaching, and involve minimal disruptions both in and out of the classroom. Limited time to complete curricula that are already full requires a teacher who is sufficiently interested to undertake a survey to select one or two versions of one instrument for use with a class. The luxury of considering a battery

of comparative variations is in the domain of the pure researcher and not the classroom practitioner. Any expectation that teachers might use them would counter the calls to include teachers in the research process.

Literature suggests that teachers would benefit from the provision of a simple instrument that indicates students' reactions to specific small-scale activities and this was the aim of this study. In this way teachers would have indicators to support their modifications to improve the use of activities with other students and of further activities with the same class.

Summary

Chapter 2 has surveyed literature that relates to educational change and attention focused on some of the calls for change from within the South East Asian region, particularly Malaysia and Singapore with whom Brunei has direct cultural and educational links. These led to various indications that teachers in Brunei are encouraged to consider altering their general approaches to teaching and learning.

Comments regarding the failure of past educational reforms included the gap between educational researchers and the teachers in classrooms who are required to convert the ideas into realities. Involving teachers in research as active and central participants rather than designating them marginal roles is considered to be important if the changes are to be effective. Teacher involvement was central to this study, which originated from a teacher's inquiry, was carried out by a classroom teacher, and required the willing co-operation of classroom teachers. It was by classroom teachers for classroom teachers. As a consequence of the classroom orientation, the practicalities and peculiarities of teaching in Brunei Darussalam government secondary schools were pivotal in many of the reactions to literature. It was vital that

teachers included in this study believed that the outcomes might have provided them with sufficient assistance to their classroom efforts to warrant their participation.

The chapter moved to considering the importance teachers' histories play in their adoption of educational changes and discussed the potential influence of the promotion of local teachers and the preferences in the employment profile of expatriate teachers by the Brunei Darussalam Ministry of Education. The context of proposed changes also has significant impact on teachers' receptivity of those changes and some traditional aspects of Brunei society were outlined. The isolation in which teachers throughout the world usually operate was acknowledged, as well as the advantages of collaboration with other teachers when attempting new educational ideas.

Characteristics of change were mentioned, including Sarason's (1990) two orders of change and Fullan's (1991) multidimensional view. Some of the difficulties experienced when coping with change were noted, including a number of the many negative descriptors that change has attracted over the years. The view that change is a process that requires time, not an event that needs an occasion, was outlined. The suggestion that a sufficient level of conflict is needed to engender some change was considered from the perspective of classroom teachers in Brunei government schools, who may consider this to be anathema to social mores. Any conflict needs balance between generating sufficient change to be effective, and yet enabling teachers to retain a feeling of job security. This is a difficult task, especially for foreign teachers with national, cultural, and religious origins other than those of their students.

Suggestions from literature to enhance teachers' attempts at instigating changes were then given. These included the need for sufficient readiness, relevance, and resources, the necessity for support and security for their efforts, and the

advantage there is in using teachers' existing skills. Teachers are advised to be selective and small-scale in their efforts, with comments that tinkering with teaching ideas increases the levels of teachers' ownership of the activities as well as their satisfaction with teaching.

While teachers may be considered quintessential to any educational change attempt, it is the students who ultimately decree the worth of any activity. Obtaining indications of students' reactions to activities formed the core of this study and a number of considerations when gathering student-perception data were outlined. The realities and perceptions of teachers within the context of Brunei government secondary schools continued to influence reactions to literature.

Instruments to obtain the perceptions of students towards various environments have been developed over a number of years and considerable literature has been produced. This study has extended the literature by focusing at the level of immediate interest for classroom teachers when they attempt new teaching and learning ideas with students. Teachers in Brunei Darussalam government secondary schools are generally reliant upon their personal subjective impressions when considering improvements to small-scale new activities. Through using the SPAID package they were able to consider alterations to those individual events cognisant of the reactions of students. This opened new directions for research into the actions of teachers and students at the small-scale level of interest, through which large-scale changes may be effected.

The second part of Chapter 2 considered a number of the dichotomous options that have been explored by researchers, as well as the hybridisation and amalgamation of existing instruments that fuel the diversity of studies into

educational environments. Chapter 3 will consider these possibilities and establish the rationality for options taken in this study.

CHAPTER 3

METHODOLOGY

This study sought a means of assisting teachers in Brunei Darussalam government schools to appraise and improve the value of activities in which they engage students through providing apposite and timely knowledge of the students' reactions to those activities. The two words "apposite" and "timely" directed many of the decisions taken in the formation of the package that became the *Students' Perceptions of an Activity Instrument and Display* (SPAID).

Chapter 3 begins by giving details of the samples that were used in establishing and trialling the survey and displays that comprise SPAID. Next comes information regarding the instrumentation used, outlining decisions made that led to the formation of SPAID. Discussions on issues of viability, credibility, dependability, and transferability of data follow, and lead on to remarks about the collection of data. The chapter concludes with comments on the statistical analysis of the data obtained via SPAID.

Sample Details

Embedding the actions, decisions, and interpretations of the study within the reality of the teaching and learning milieu of government schools in Brunei Darussalam was central to this thesis. All involvement of teachers and students occurred within normal school operations and not for the purpose of this study only. This influenced the participation of teachers and students in the study, as well as the selection of activities and the sites at which these activities occurred. Remarks on

these influences follow, but first is a comment on a further influence that is generated from the general good will and pleasantness of people within Brunei society.

Acquiescence-to-authority bias. Traditional hierarchical structures permeate society in Brunei Darussalam and education is no exception. Embodied is a general acquiescence to the desires of those in positions senior on hierarchical ladders. The tendency for individuals to provide responses aimed to please those in positions of higher authority has the potential to interfere with obtaining honest and accurate data. Procedures to circumvent this *acquiescence-to-authority* bias of data were considered to improve the credibility of the findings. My position throughout the study was as a foreign national and I did not hold a hierarchical position of responsibility beyond that of an ordinary classroom teacher of mathematics.

Information was initially elicited from teachers whom I approached on a personal level rather than through school administrations. These teachers had shown an interest in the use of activities that were outside the traditional teaching practices endemic in Brunei Darussalam classrooms. They occupied hierarchical levels higher than my standing within the school system and the voluntary nature of their participation was stressed to them. In this way the teachers who participated were willing in their contribution of information rather than being obliged to participate by directives from school authorities.

Concerns that personal approaches may have led to teachers feeling obligated to respond were alleviated through some teachers declining the opportunity to participate. This study was by teachers for teachers, and encouraging the genuine goodwill, interest, and willingness of individual contributors was influential to several of the pragmatic decisions throughout the formation and trials of SPAID.

Teachers

This study originated in mathematics and science classrooms of Brunei Darussalam government secondary schools and it is from these school subjects that the initial sample of teachers was drawn. As the study progressed it was noted that teachers' interests were towards general indications of students' reactions rather than those that may be specific to the teaching of mathematics or science. This presented the opportunity to include teachers from other disciplines in the study.

An important aspect throughout this study was the voluntary participation of teachers. The hierarchical structure of the Brunei educational administration system and the acquiescence-to-authority bias lends itself to providing researchers with a ready source of captive data. Presenting permission obtained from a central authority to a school principal could be viewed as tantamount to an implicit mandate for teachers to participate. This may have yielded fuller returns of responses than were received through personal approaches, but I had serious concern over the credibility of any response obtained through this approach. Teachers' participation had to be voluntary and honest, so approaches to teachers were low level and personal rather than high level and authoritatively directed.

Five experienced teachers within the milieu of Brunei Darussalam government secondary schools (Table 3, Teachers A to E) contributed the initial suggestions from which the five characteristics used in the SPAID package were established. These teachers were all known to me through professional associations and reliance upon this initial convenience sample opens the sample to accusations of being what Patton (1990) described as "information-poor" (p. 183). To help offset the low number of contributing teachers, all teachers who later participated in the various stages of developing and use of the SPAID package were asked for their

comments regarding the characteristics identified by the initial contributors, as well as any other aspects of the study that may have been of interest to them. This increased the scope of the sample and provided an accumulative and continual review of the decisions made during the study, thereby improving the richness of information.

Table 3

Profiles of Teachers who were Involved in the Development of SPAID

Establishing SPAID Survey				
Teachers who contributed the initial suggestions for characteristics				
Teacher	Sex	Origin	Subject	Position
A	Male	Brunei	Mathematics	Head of Department
B	Female	Malaysian	Science	School Inspector
C	Female	Brunei	Mathematics	Head of Department
D	Male	European	Science	Head of Department
E	Male	European	Mathematics	Head of Department
Establishing student versions.				
Initial Bahasa Malay wording				
F	Male	Brunei	Geography	Teacher
Check Bahasa Melayu-English translation				
G	Male	Tutong	Geography	Teacher
H	Male	Muara	Science	Teacher
I	Female	Tutong	English	Teacher
J	Male	Tutong	Bahasa Melayu	Teacher
K	Male	Tutong	Geography	Teacher
Final back-check				
L	Female	Bandar	Administration	Deputy Principal
Check English construction appropriate for use with students				
M	Female	England	English	Teacher
N	Male	England	English	Teacher

(table continues)

Teacher	Sex	Origin	Subject	Position
O	Male	Wales	English	Teacher
P	Male	Australia	English	Teacher
Q	Female	Australia	English	Teacher
R	Female	New Zealand	English	Teacher
S	Male	England	English	Teacher

A combination of local teachers from Brunei Darussalam and teachers from countries other than Brunei was approached to contribute possible areas of interest for this study. Table 1 in Chapter 2 indicates that there is an approximate 2:1 ratio of local to expatriate (foreign) teachers in government schools. The number of local teachers employed includes personnel concerned with administrative duties, teachers of the Bahasa Melayu language and other subjects in which foreign teachers provide minor contributions.

Respondents to a recent questionnaire on teacher concerns in Brunei (Wong et al., 1999) comprised 44% who could be identified by type of service as local teachers, 35.8% as foreign contract teachers, and 20.2% as those employed on month-to-month or day-to-day contracts, or by some other arrangement. The 20.2% group consisted of both local and expatriate teachers, and included many expatriate wives whose husbands were employed by the government in some capacity. Consequently, the balance between local and expatriate teachers of mathematics and science classes was considered to be more evenly balanced than is suggested by Table 1, perhaps even slightly in favour of expatriate teachers. These proportions were borne in mind when approaching experienced teachers for comments.

Students

The participation of students in this study had to cause minimal interruption to their normal class procedures in order to emulate the normal teaching routines and

to encourage students' honest participation. Additionally, teachers retained control over the selection and application of activities and the students involved.

The number of survey forms completed by students totalled 383 (Appendix F), consisting of the intact classes that were managed by teachers. An attempt was made to limit the influence of the acquiescence-to-authority bias that might have students supplying responses that they considered the teacher wanted to receive. A previous study within Brunei (Nannestad, 1997) found that students' willingness to respond honestly was notably increased when anonymity was overtly demonstrated and strictly observed. Students' responses to the survey in this study were therefore anonymous, removing a barrier that might have prevented some students providing responses that exhibited negative perceptions of the activities.

A further reason for anonymity came from the desire for the study to reflect the reality of teaching in the government schools of Brunei Darussalam. There are several barriers to communication between teachers and students under normal conditions. Teachers would have to generate an unusual situation in order to discuss an individual's response with the student concerned. The twenty-minute break halfway through the teaching day would appear to provide a likely opportunity to seek out individuals. However, teachers seldom interrupt students over this time, and to do so would create sufficient interest amongst the students that any attempt to generate a confidential discussion with the individual would be counter-productive.

Cultural, linguistic, racial, and religious differences between the students and the expatriate teachers also present pervasive barriers to open communication. Consequently, teachers who used the SPAID package as part of their normal practices were unlikely to be afforded the luxury of discussing a specific response to an item with the contributing student before engaging the next class in the same

activity. However, the loss of opportunities to investigate individual students' responses to particular items was considered to have been more than compensated for by the promotion of honest data and the reflection of reality.

Teachers did consider that matching responses to the sex of students might be useful in identifying possible different reactions to the activities. This is supported by research in Brunei Darussalam that identified gender differences in learning environments (Riah & Fraser, 1999). The majority of responses for this study were gathered in one of the few single-sex schools in Brunei Darussalam and so the facility to distinguish between responses by gender was not explored in this study. Teachers considered it to be unlikely that students' indicating whether they are male or female would broach anonymity and restrict their provision of honest data. Collection of other biodata from the contributing students was not contemplated.

Activities

The intention of this study was to provide teachers with knowledge of their students' perceptions of specific activities within their normal praxes. Consequently, activities included in this study were initiated by the teachers for their own use, rather than being generated to produce data for a study. This, together with the voluntary nature of teachers' involvement, prevented preselection of the activities.

There were eighteen different activities for which students completed the survey in this study (Appendix F). For teachers to have deemed the effort of administering, processing, and considering data to be worthwhile they had to have had sufficient interest not only in the activities, but also in improving the efficacy of those activities. In addition, teachers needed to have prior indications that the information obtained would be worth the effort for them to participate. This was

considered to provide a significant and realistic test by practising teachers of the practicality and viability of the SPAID package.

Research Sites

This study was designed to help practising classroom teachers in Brunei Darussalam government schools to improve the new activities that they try with classes. It was important that all of the phases of this study occurred within the existing structures and teaching programmes of the teachers and schools. Consequently, sites for this study were the locations that the teachers would have chosen to engage students in the new activities irrespective of their use of SPAID. These included the classrooms that classes usually occupied for lessons, an outdoor location within the school compound, and another location a distance of two kilometres or so into the nearby jungle.

Instrumentation

This section outlines many of the decisions that culminated in the formation of the SPAID package, and an outline of events is given in Table 4. Differences between the students in Brunei Darussalam government schools and many of the foreign teachers contracted to teach them provide challenges to the teaching and learning that occurs. Considerations based upon linguistic differences permeated many of the decisions made in this study and this section begins with linguistic considerations that led to the provision of two student versions and one teacher version of the survey within SPAID. The second part of the section comments on the steps taken to create the survey and displays that comprise SPAID.

Table 4

Outline of events in the formation of SPAID

Event	Year
Identification of concepts	
Original question posed by teaching acquaintance	1996
Teachers asked for indications (Table 3, Teachers A to E; Appendices G1 to G5).	1996
Survey of existing instruments (Appendix B)	1996
Potential Characteristics returned to teachers.	1996
Short-list of items established (Appendix I).	1997
Linguistic versions	
Initial Bahasa Melayu version formed.	1997
Bahasa Melayu version shown to five other teachers to assess comprehensibility of instructions and items by students (Table 3, Teachers .G to K).	1997
English version formed following discussions with teachers of English in government schools (Table 3, Teachers M to S).	1997
15-item list shown to UBD lecturers.	1997
Bahasa Melayu version shown to two classes to resolve differences in wording.	1998
Final translation check.	1998
Presentations at Conferences	
UBD international	1999
Mathematics teachers	1999
Trials of SPAID outlined in Appendix F	

Linguistic Considerations

The levels of language knowledge of participants in this study impacted throughout the development of the survey in SPAID. English is at least the second language for all but a few students in Brunei Darussalam government schools. In addition, it is unusual in the traditional educational milieu of Brunei Darussalam for students to be asked to offer opinions, suggestions, or criticisms directly to the teacher concerned. A challenge for this study was to establish an instrument that used a genre of language students would consider conformed to expected cultural bounds, yet broached barriers to communication to provide a safe vehicle for them to offer honest and open expressions of opinions. Decisions that led to the formation of two student versions of the survey are outlined, and are followed by a comment on the teacher version of the survey that parallels the student versions.

Two Student Linguistic Versions

The population of Brunei Darussalam speaks a number of languages and dialects. Bahasa Melayu is the official language of the Sultanate (Brunei Yearbook, 1999) while English is the language of instruction and examination for most secondary school subjects. Providing students with two linguistic versions of the survey, one in Bahasa Melayu and the other in English, was considered important to improve the viability of the survey for use with the majority of students. They could then choose the version with which they felt more comfortable.

Language versions development. The national concept guiding Brunei Darussalam is Melayu Islam Beraja (Malay Islamic Monarchy), which directs the national culture to be Malay, and promotes Bahasa Melayu as the national language (Brunei Yearbook, 1999). Brunei Darussalam has its own regional variants and dialects of Bahasa Melayu, as well as numerous other languages, producing a myriad

of language variations that are influenced by region and social setting. An official version of Brunei Bahasa Melayu is developing but not all students or teachers may have been familiar with, or aware of, the continuing changes. A challenge for this study was to choose a version of Bahasa Melayu acceptable to a wide range of students in Brunei Darussalam.

Attempting translations that cross over linguistic and cultural boundaries is not easy and difficulties were expected. The propensity for meanings to alter subtly through translation limited the accuracy of conveyed meaning. I did not possess the linguistic ability to provide necessary translations and so was entirely reliant upon the abilities of local colleagues to do so. Considerable care was required to ensure compatibility between the student Bahasa Melayu version and the translation into English.

An initial Bahasa Melayu version was constructed by discussing the intent of each instruction and item for the survey with a local teacher knowledgeable in various Bahasa Melayu dialects and English, and who was empathetic with the language comprehension of students (Table 3, Teacher F). He formed a draft version that was passed on for comment to five other local teachers from different areas of the country (Table 3, Teachers G to K). Local speakers were expected to have predilections towards their familiar or favoured dialects and they did maintain minor differences of opinions regarding the acceptability of some linguistic variations, leading to considerable discourse. The final local language variation was confirmed through the instructions and items being discussed with two groups of students from different parts of the country. One group consisted a Form 3 science class of 26 students conducted by the teaching acquaintance with whom the ideas for this study were initiated. The other group was my Form 6 mathematics class of 18 students. We

each questioned our respective classes regarding their understanding of the intent of the instructions and items, and were convinced students' comments were as open as we could expect. They verbally translated the Bahasa Melayu version of the survey into English and used words near identical to those of the survey apart from one instance. In this case a word similar to that used in the survey was considered, and on questioning, the students agreed that they regarded both words to be equally appropriate.

A further back-check was completed by obtaining a translation of the English back into Bahasa Melayu through another colleague who had had no part in the development of the survey up to that time (Table 3, Teacher L). I had a high regard for her linguistic knowledge and experience in both Bahasa Melayu and English. This process presented a completed cycle that confirmed the translation. A final translation back into English by new cohorts of students from two different regions of the Sultanate added certainty.

It was considered necessary to complement the student Bahasa Melayu version with one in English to cater for students and teachers who were not sufficiently proficient in Bahasa Melayu to use the original version. There is a rich diversity of languages and dialects within Brunei, some of which can be the first languages of students who are not necessarily familiar with Bahasa Melayu. English is the medium of instruction for mathematics and science in Brunei secondary schools, forming a unifying language in these and many other school subjects. Foreign teachers unfamiliar with the Bahasa Melayu language are employed to teach in Brunei Darussalam secondary schools and it was judged that these teachers would be more likely to use the survey if there existed an English translation of the student version.

Simple and direct. English may be the medium of instruction for the majority of secondary school subjects in Brunei Darussalam but it remains a foreign language to most students. Teachers of English in Brunei Darussalam government secondary schools have considerable knowledge of, and realistic classroom experience with, students' linguistic levels. The linguistic structure of the English version for each item was discussed with seven such colleagues from two schools (Table 3, Teachers M to S).

Simple sentence construction throughout the instrument was preferred in order to cater for other than first language users, many of whom may also be young students. Similar consideration of language was used when the Learning Environment Inventory (LEI) was adapted to form the instrument My Class Inventory (MCI) (Fraser, 1982a; Fraser & Fisher, 1983a,b). Direct and positive statements were also preferred as negative items can contain syntactical complexities (Taylor, Dawson, & Fraser, 1995) that English-teacher colleagues believed likely to lead some students to misinterpret the intent of the items.

Research indicates that examinations and percentage results are central concerns for secondary school teachers in Brunei Darussalam (Wong et al., 1999). Teachers are aware of greatly increased tension for students during their years in Forms 3, 5, and Upper 6, which terminate with external examinations. This increased the requirement for the use of simple language in the instrument as teachers were expected to be more willing to attempt activities that varied from expected norms during the earlier years of secondary schooling than during years of external examinations.

Alternative language structure. General English usage in Brunei includes idiosyncratic phrases and grammatical constructions peculiar to the country

or region that could be considered linguistically erroneous by native English speakers. Including such errors was considered acceptable in the formation of the instrument, provided they contained wording and syntactical forms sympathetic to the language uses familiar to students.

Teacher Version

A teacher version of the survey was established (Appendix A) to parallel that of the students so teachers could record their estimations of the students' responses for each item. Psychosocial instruments have been used in studies that have identified differences between students' and teachers' perceptions of the same educational environments (Fisher & Fraser, 1983a,b; Fraser, 1982b, 1984; Fraser et al., 1992; Fraser & O'Brien, 1985; Fraser & Rentoul, 1980; Wubbels et al., 1991). Analysis of data was expected to begin whilst it was being collected (Merriam, 1998), so teachers were encouraged to record their own responses prior to looking at those of the students in order to prevent being influenced by the students' responses. The teacher version was established only in English, as the majority of secondary school subjects in Brunei Darussalam are required to be conducted in the medium of English, and most teachers were expected to be conversant with the language.

Instrument Formation

An outline of the steps taken to create the SPAID package follows. This section describes the categories that were of interest to teachers and then moves to the criteria that were established to enhance the practicality of SPAID for practising classroom teachers. Comments regarding the form of responses apposite for use with students in Brunei Darussalam lead on to remarks about establishing the format of the items within the survey. Attention then moves to the displays of data that teachers obtained through the use of SPAID. Teachers needed to find information easy to

obtain and readily comprehensible if they were to consider using SPAID as a part of their evaluation of new activities with students.

Characteristics

Identification of characteristics. Establishing characteristics of interest to teachers was the first step in the formation of the survey used in this study. Eight teachers with experience in Brunei Darussalam government secondary schools and who had an interest in the use of varied activities within teaching were approached for suggestions. Five returned responses (Table 3, Teachers A to E) and these are given in Appendices G1 to G5 and summarised in Appendix G6. Selection of characteristics from the teachers' comments aligned with four guidelines for the development of categories offered by Guba and Lincoln (1981). These are: (i) the number of people who mention the characteristic; (ii) the importance of the characteristic to the audience (teachers); (iii) the uniqueness of the category; and (iv) whether it is an area given little recognition in other response feedback.

The categories that the experienced teachers supplied were compared with the learning aims of secondary education published in examination syllabi for lower secondary schools (Curriculum Development Department, 1994) and upper secondary schools (University of Cambridge Local Examination Syndicate, 1996). These were later compared with early results from a survey on the concerns of Brunei secondary school teachers (Wong, Nannestad, Lourdusamy, & Veloo, 1998). Five common categories of interest were identified and a list of these was returned to the contributing teachers for confirmation.

Fitting characteristics to existing instruments. The five characteristics identified by experienced teachers were compared with established psychosocial environmental instruments (Appendix B). Utilising an existing instrument in its

entirety was the preferred option. However, the nature of interest for this study was to consider individual activities rather than the general environmental impressions that are the usual focus of educational psychosocial instruments.

Initial interest in existing instruments lay towards class-level instruments such as the Classroom Environment Scale (CES) developed by Moos (Fraser, 1994; Fraser & Fisher, 1994), and the Learning Environment Inventory (LEI), which has been used predominantly for investigating associations between student learning outcomes and perceptions of classroom environments (Fraser, 1994; Fraser & Fisher, 1983a). School-level instruments were also considered, such as Moo's *Work Environment Scale* (WES) (cited in Fraser, 1994) with its Innovation scale.

No single existing instrument was considered to provide appropriate coverage of the five characteristics and interest moved to contemplating a hybridisation of existing scales or even individual items. The intent of each scale and item from the existing instruments was appraised for inclusion. No complete scale from an existing instrument was accepted and it was decided to establish a new instrument. The wording of items was considered and configured bearing in mind the linguistic considerations given previously.

The collection of possible items (Appendix I) was returned to contributing teachers for review and comment. Their comments and the preference for a short instrument led to me and the teaching acquaintance who initiated the questions that led to this study, to reduce the number of items to 15. The refined list was then passed to three mathematics and science educators at the Universiti Brunei Darussalam to establish face validity.

Instrument Criteria

The direction of the study was to provide classroom teachers with a viable means of obtaining student-perception information following the use of a new teaching and learning activity. Practicality featured highly throughout the study and the following set of criteria was established to enhance the viability of the SPAID package for practising teachers.

Timeliness of results. Provision of information needed to be timely to be of assistance to teachers wishing to improve the benefit of teaching and learning activities. It is usual for teachers in Brunei government schools to be assigned multiple classes at the same level with which they undertake the same content concurrently. Those who do introduce varied activities may expect to repeat the same activity with each of their classes over a short period of time. To be useful in the adaptations of the activities, information about students' perceptions would need to be available between successive engagements with classes.

Criteria established for this study included the need to gather data within the same teaching period as the activity occurred, and that no more than 10 minutes of class time be required to obtain the data. Processing and considering results needed to be completed prior to the next iteration of the activity. School days in Brunei Darussalam government schools are divided into eight 35-minute periods. Lessons usually occupy two periods at a time, lasting for 70 minutes. Single 35-minute periods are rare but do occur. The minimum noncontact time with students that a teacher may expect to have is one period, and so the time for processing and beginning to consider data was set at under 35 minutes. Reducing the time criterion further to 20 minutes allowed 15 minutes from a single 35-minute period for teachers

to gain access to a computer, as well as time for accommodating interruptions that are pervasive to teachers' routines.

Short form. The need for rapid provision of information required the instrument to be short and easy to use. Various educational environment instruments have been reshaped into short versions in response to teachers' preferences for more rapid and economical instruments that require less time to administer and score (Fraser, 1982a, 1989b; Fraser & Fisher, 1983a,b; Fraser & Tobin, 1989b). The Individualized Classroom Environment Questionnaire (ICEQ) (Fraser & Fisher, 1983a) and the Classroom Environment Scale (CES) (Fraser & Fisher, 1983a; Fraser, 1994) provide two instances. The My Classroom Inventory (MCI) (Fraser, 1982a; Fraser & Fisher, 1983a,b; Fraser, Malone, & Neale, 1989) is a shortened and simplified version of the Learning Environment Inventory (LEI), having been redesigned for use with younger students.

Limiting the time commitment for classroom teachers led to restricting the instrument to fit onto a single side of A4 paper, ensuring brevity for students completing responses and for teachers administering and processing responses. This also facilitated presenting students with both linguistic versions of the instrument, one being on each side of the same sheet of paper. Included on each side were all instructions, the items, and the students' responses, thereby reducing the potential for transference errors (Fraser, 1989b; Fraser et al., 1992).

Response Options: Quantifiable Likert-Type Responses

It was considered desirable for students' responses to be compatible with existing education practices of Brunei Darussalam. Teachers are busy people pressured by the daily demands of the job, and although a prerequisite for teachers' involvement in this study was that they desired to improve the activities, the

administration and processing of data needed to be minimal if they were to consider using the SPAID package. Students needed to respond quickly and directly to easily-answerable items and the processing for teachers needed to be rapid and straightforward.

The need for rapid procurement and processing of information suggested Likert-type scales to be apposite for this study, as they are amenable to the provision of rapid responses and can be objectively scored (Rentoul & Fraser, 1983). Teachers in Brunei are well acquainted with considering numerical outcomes when summarising many aspects of education, from students' attendances through to the annual assessment of their own performances as teachers. Consequently, the use of a simple instrument to provide direct numerical summaries was well suited to teachers operating in the Brunei education system.

Item Format

This section considers some of the decisions that were made regarding the format of items in the survey within the SPAID package. These needed to give students opportunities to provide indications of their perceptions, and yet at the same time restrict their responses to conform to the criteria established. The survey provided indications of students' actual and personal perceptions of activities. Positively worded items were preferred, cycling through the five characteristics. Students were given four options for responses to items; and an additional open-ended item at the end of the instrument provided the opportunity for them to contribute suggestions for improving the activity and to add comments that were not catered for within the Likert-type items.

Actual private beta-press. Murray (1938) introduced the terms *alpha-press* to the description of environments by a detached observer, and *beta-press* to

the description of environments by those within the environments. Data gathering methods in this study aimed at the beta-press level since the organisation that would be required to obtain the services of a detached observer to be present throughout an activity with a class would be unrealistic within teachers' normal operations.

Items within the survey were orientated towards the *private beta-press* distinction of Stern, Stein, and Bloom (cited in Fraser, 1994), "the idiosyncratic view that each person has of the environment" (p. 496), rather than the shared view members of a group hold about the environment, or *consensual beta-press*. This was due to class teachers having the unique opportunity within school systems to consider the impact of particular activities upon individual students. Administrators at higher hierarchical levels necessarily become removed from individual students through their supervisory roles; heads of departments focus on attainment within their department through considering results of classes as whole entities, school administrators use departmental summaries to assess school attainment, and so on. The perceptions of individual students form the fundamental unit of interest for class teachers when considering the impact of activities on academic achievement or other outcomes. Hence the interest in this study focused on the students' private level of response.

Items in the instrument obtained indications of students' actual perceptions following engagement in an activity, rather than indications of ideal or preferred activities. Items that focus upon students' actual perceptions require simpler linguistic constructions than those evoking an ideal or preferred situation that may require a conditional clause. *I enjoyed the activity* is a simpler statement to grasp than *I would like to have enjoyed the activity*, the English of which contains considerable propensity for comprehension difficulties for students in Brunei for whom English is

a second or third language. Consequently, items in the instrument were directed at the actual private beta-press distinction.

Preference for positive items. I considered it preferable to use items with positive wording rather than mixing the use of positive and negative responses that is standard practice in the formation of instruments (Dorman, 1996). This avoided the conceptually complex syntax associated with negative wording (Taylor et al., 1995) that could confuse students' understanding of items. Also, the intent of this study was to encourage teachers and students in their use of varied activities for teaching and learning within the traditional Brunei educational environment. Using positively-worded items might have encouraged students to regard activities from positive perspectives rather than negative directions that might encourage searching for fault.

Four options. Students were provided with four response options for the Likert-type items. The need for rapid information favoured reducing the number of response options as far as possible to simplify students' decision making. The least number of response options is two, as used in the My Class Inventory (Fraser & Fisher, 1983a). Natural acquiescence towards the wishes of authority figures within traditional Brunei society, together with school students in Brunei Darussalam seldom being asked for their personal opinions on educational matters, could conspire to act against students being willing to respond with extreme negative responses. I wanted to provide sufficient response options so that they were able to indicate an inclination either towards or away from an activity without incurring an extreme response. Therefore, more than two options were required.

An even number of response options for students was chosen for the study. This required students to consider the activity and then make decisions in either a

positive or negative direction. An odd number of response options would present a safe or noncommittal middle ground that, if taken, would have given teachers little information to help them improve activities. However, no-comment responses were available through leaving responses blank, an option some students chose. The use of four-point Likert-type responses required students to form conscious decisions when considering responses and provided opportunities for them to offer mild criticism of an activity with little fear of causing offence to the teacher.

Open-ended item. An open-ended item was included at the end of the instrument to provide students with an opportunity to offer suggestions for improving the activity and to give them an avenue to offer comments not catered for in the Likert-type items. This opened an avenue for students to relate valuable information of natures other than those anticipated in the formation of the instrument. Teachers may be unaware of cultural or other aspects influential in a teaching context which might have a marked influence on students' reception of the activity. The open-ended item provided students with a secure channel for communication through which the teacher could be informed of barriers to the use of activities. These otherwise would have gone undetected.

Cycling items. The majority of educational environment instruments listed in Appendix B cycle the items through the domains or scales and this instrument continued the practice. Teachers who engage students in new activities may well be pressed for time, leading to some students having difficulty completing their responses to the instrument. In such instances the cycling of items would provide teachers with some indications of students' responses across several categories.

Data Display

The manner of data presentation to teachers was believed an important factor in establishing the survey as viable to teachers in Brunei. Data compilation and processing needed to be simple, quick, and straightforward if practising teachers were to consider using the survey to investigate their students' perceptions. Human minds have the ability to absorb data pictorially, which explains the preponderance of graphical displays within educational environment literature. The sector graphs used by Wubbels (1993) (Figure 3) provide an example of a graph that also forms a distinctive and identifying feature of his *Questionnaire on Teacher Interaction* (QTI). The QTI contains eight scales and each is represented by a section of the octagonal outline. Profiles for individuals or groups are obtained by adding the responses within each scale. Sections are then shaded from the centre to a linear distance that proportionally represents the total for that scale.

Computers

Secondary schools in Brunei Darussalam are equipped with IBM compatible computers that contain the spreadsheet program Excel. The ready access to this program for teachers prompted the formation of a template that uses the automatic graphing features within Excel to help in the collation and display of data. This reduced teachers' processing tasks and sped the production of summary information. Opinions and suggestions about the displays were sought from all teachers who contributed throughout the study and various display options were discussed with them. This was part of the accumulative and continual review of the decisions made during the study.

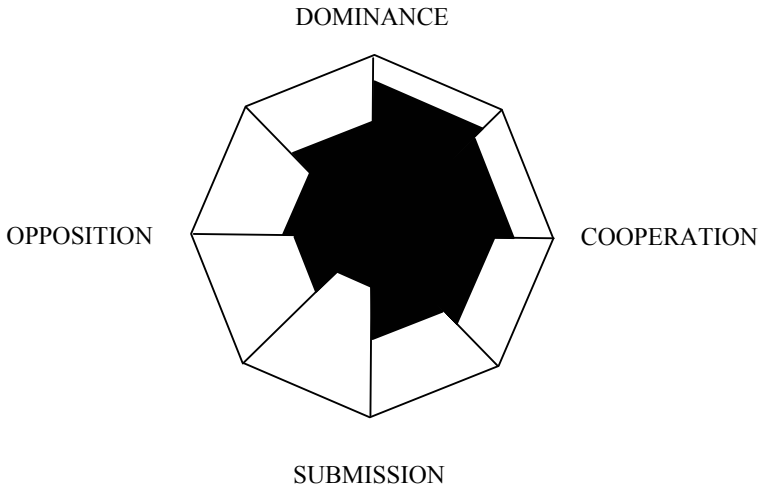


Figure 3. An example of the distinctive octagonal display used to display responses to the Questionnaire on Teacher Interaction (QTI) (Wubbels, 1993).

Linear graphs have been used in educational environmental instruments to represent data, being useful for displaying and tracking multiple sets of data on the same axes. Figure 4 provides an example. Plotting students' and teachers' responses on the same set of axes provides a simple means of contrasting their perceptions, with significant differences between the data being readily identified. The order of scales listed in these graphs is generally incidental but could be inferred to reflect prioritisation. Lines connecting the response scores are included to ease readers' tracking of the responses from the different groups. These are suggestive of interpolation but are of no statistical significance, which might be a point to vex mathematics teachers charged with educating students on the correct use of graphs.

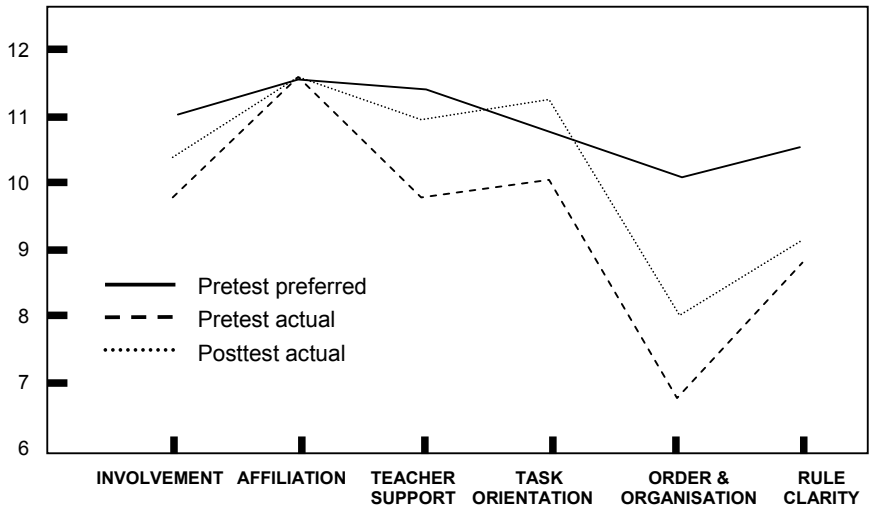


Figure 4. Example of a linear scale used to display several domains from the same environmental instrument (Fraser, 1994, p. 523). National Science Teachers Association.

Wubbels' (1993) idiosyncratic sector graphs with the QTI provide an alternative to the use of line graphs and literature discussions conveniently circumvent h

between scale factors for lengths, areas, and volumes of similar images is the focus of many examination questions faced by students in Brunei (Nannestad, 1997) and teachers who use the QTI may experience conflict using a display in which a doubled response score is represented by a quadrupled area. There is also a conflict between the triangles that depict responses being referred to as sectors in the literature (Riah, Fraser, & Rickards, 1997; Wubbels, 1993). Locating a suitable style of graph for use with SPAID required a compromise. Final decisions regarding the appropriate use of graphs were based upon teachers considering the graphs, then readily understanding and interpreting the information, irrespective of mathematical correctness.

Hand Processing

Obtaining rapid displays of readily comprehensible summary data was deemed quintessential to the SPAID package being viewed by practising teachers as viable for use. The requirement that summaries be available to teachers within 20 minutes during a normal school day increased the need for the processing of data to utilise computers. However, it was appreciated that there may be occasions when teachers do not have access to computers and for these instances a method of processing data by hand was also investigated.

Credibility, Dependability, and Transferability

The methodology used in the formation and trial of SPAID is now considered from the perspective of credibility, dependability, and transferability. These concepts replace the traditional criteria of reliability and validity that are difficult to apply to studies of human responses (Merriam, 1998).

This section begins by outlining two conditions that exemplify difficulties inherent to approaching such studies from the positivist perspective; the propensity for data relating to human behaviour to be nebulous, and the need for practising teachers to deem the use of the SPAID package viable within their praxes. Discussion then moves to credibility, which replaced internal validity, to view whether the data reflected the reality of teaching in Brunei Darussalam. This applied to both the development of SPAID and to the use of SPAID by teachers. Dependability of findings replaced reliability, and was notably influenced by the nebulous nature of the data and the interpretations of the behaviour that the study sought to obtain. Transferability replaced external validity and considered whether findings can be transferred to situations beyond those specific to this study.

Nebulous Nature of Data

Human behaviour is never static (Merriam, 1998) and use of the survey and computer graphing template that constitute the SPAID package connected several layers of nebulous human behaviour, as well as interpretations of those behaviours. These layers include the original identification of categories by teachers, students' reactions to activities and their responses to the items within the instrument, teachers' interpretations of students' responses, and teachers' reactions when considering potential changes to those activities. Each is subject to fluxion since students' and teachers' reactions are expected to vary in response to the myriad of contributing factors that influence teaching. These factors include the timing of the activity and its proximity to other events both in and out of school, the students' academic abilities, their experiences and receptivity of new activities, and the forms of assessment for the outcomes. Additionally, the weather can be particularly influential to students' reactions to teaching and learning activities, especially humidity in tropical Brunei.

The list of factors that influence the teaching and learning in classrooms is extensive and may be inexhaustible. Teachers do not have control over many of the factors and, in some cases, may not even be aware that factors are influencing their lessons whilst in the midst of juggling the consequences of those influences moment-by-moment in their daily practice.

Every presentation of an activity by a teacher to a class was unique. The participants' human reactions reflected their impressions that were dominant at the time. This gave data from SPAID a considerably nebulous quality. Appreciation of teachers' reactions to the data needed recognition of the events particular to a moment in time rather than to a positivist interpretation of reality that would have

been the case with traditional considerations of validity and reliability (Merriam, 1998).

Viability

Practicality was vital to this study and credibility, dependability, and transferability were worth considering only if classroom teachers accepted that the use of the SPAID package might be viable within their own existing procedures. Not only did teachers need to believe the potential information to be beneficial, but that the method of collecting and processing data would require acceptable levels of intrusion and disruption to existing routines. Displays of data needed to be readily understandable by teachers, who were then required to convert these displays into possible improvements that they considered were both feasible and reasonable within the given time and resources.

Credibility: Internal Validity

This section focuses on the measures taken to enhance the credibility of the SPAID package for classroom teachers in Brunei Darussalam government schools. Internal validity traditionally refers to the matching of findings to reality (Merriam, 1998) but differing perspectives of situations produce differing appreciations of that reality. Teachers form perceptions of students' reactions to activities, which might not always agree with outcomes from the SPAID process. Teachers needed to believe that any differences between their own estimations of students' responses and those presented through SPAID were credible if they were to consider their use of SPAID to be justified.

Discussion on credibility of results in this study continues with a comment regarding the need to counter the personal bias I brought to the study. Then follow outlines of the steps to establish the credibility of the SPAID package, first, during

the formation of the survey and the displays that comprise SPAID, and second, during the trials that evaluated the SPAID package as viable for teachers. Having taken the risk of using SPAID with students, teachers needed to believe the data that they obtained were useful to their considerations of the activities in which they engaged students.

Researcher's Bias

This study was designed to assist classroom teachers to improve the effectiveness of new activities through providing information regarding the students' perceptions of those activities. I, as the researcher, was a member of this set of teachers. Hence, steps to establish the credibility of results were more important than if I were an external researcher. The potential for my bias towards outcomes needed to be borne in mind when considering results. Techniques such as member checks, face validation, continual questioning and evaluation of results by peers (Guba & Lincoln, 1989) were important to retaining a balance in perspective and to limit any influence I had on the interpretation of results. If the study were to benefit teachers generally in classrooms it was important that SPAID satisfied needs for them rather than being a useful tool for me alone.

Formation of Survey and Display

The comments and suggestions of practising and experienced teachers within Brunei Darussalam were essential throughout all phases of the study. Constant collaboration and participation ensured that the interpretations of data were cognisant of the long-term observations that these teachers had accumulated over many years of classroom experience with students in Brunei.

Verification, authentication, triangulation. Attempts to confirm human behaviour through triangulation are particularly prone to gathering conflicting data

(Merriam, 1998). Mathison (1988) suggested shifting triangulation away from a technological solution, preferring to rely on "a holistic understanding" to obtain "plausible explanations about the phenomena being studied" (p. 17). Guba and Lincoln (1989) offered that "member-checking processes ought to be dedicated to verifying that the constructions collected were those that had been offered by respondents, while triangulation should be thought of as referring to cross-checking specific data items of a factual nature" (p. 241). The previously-mentioned forms of verification in this study were invoked to enhance the credibility of decisions. They also demonstrated to teachers that their opinions were not in isolation and that their contributions were credible and worthy of consideration.

The initial identification of characteristics of interest to teachers that formed the focus of SPAID was obtained through approaching experienced teachers on a personal level and a small number of teachers were expected to contribute. Five teachers offered initial responses from which five characteristics were identified. These were then subjected to member checks through referring the interpretations back to contributors for confirmation (Merriam, 1998).

The characteristics were face validated by members of the Department of Science and Mathematics Education, Sultan Hassanal Bolkiah Institute of Education (SHBIE), Universiti Brunei Darussalam. Literature and referral to teacher educators added depth and variety to the verification process, but true testing of credibility required input from other practising classroom teachers. Hence, a cycle of continual questioning, reevaluation, and peer examination was invoked (Merriam, 1998). Teachers who participated at any stage in the development of the SPAID package (Table 3) were asked for their comments and suggestions regarding all stages of development.

The SPAID package was also presented at two conferences held in Brunei Darussalam in 1999 and the audiences were asked for suggestions and comments. University mathematics and science educators as well as a number of classroom teachers were given this opportunity at the annual international conference held by the Department of Science and Mathematics Education, Universiti Brunei Darussalam. The second conference in 1999 was specifically organised for all government employed secondary school mathematics teachers in the Sultanate. Attendance of these teachers at the second conference was compulsory and two of the three days spanned holidays, conditions conducive to inciting umbrage that may have increased the willingness of this audience to provide critical comments and suggestions.

Trials of Instrument and Display

Interpretative qualitative. The second phase of the study involved evaluating the SPAID package through teachers' uses within the milieu of normal teaching in Brunei Darussalam government secondary schools. Credibility was enhanced through the trials occurring within naturalistic settings, involving the classes and lessons that teachers would have conducted irrespective of their use of SPAID. An interpretative-qualitative approach was employed (Merriam, 1998) with data considerations requiring understanding of the meanings people constructed and the context in which their interpretations were formed.

Teachers' long-term observations. Teachers who were sufficiently open to using new teaching and learning ideas with students in Brunei and who were also sufficiently interested to use the SPAID package when considering improvements to activities were expected to be receptive to any findings that might differ from their

own perceptions. However, individuals' personal observations are always important in their own assessment of activities (Hargreaves, 1992) and will never be excluded.

In this study the perceptions that teachers held prior to their use of SPAID had been established through their years of teaching experience. Any students' responses that fell well outside teachers' expected boundaries were likely to become subject to close credibility inspection. Hence, teachers' experiences had the potential to provide both confirmation of data and a source of conflict.

Data to establish the creditability of the study were obtained through semi-structured interviews with teachers after they had used the SPAID package. These discussions amalgamated several aspects of qualitative research and case studies as described by Merriam (1998): basic or generic qualitative through the collecting of interviews, ethnographic with all responses requiring sociocultural analysis, and phenomenological as the focus of each case was on the teachers' uses of the instrument and displays in their evaluations and modifications of activities between their iterations of the activities with successive classes.

Students' responses. Attempts by classroom teachers to establish that students' responses were indicative of their perceptions of the activity at the time were frustrated for several reasons. These include an encultured separation between teachers and students, the acquiescence-to-authority bias, linguistic and cultural differences, and the time available between iterations of activities. Confirmation of the credibility of students' responses in this study was enhanced through overt anonymity. No students' names were required and care was taken in the collection of response forms so students would be sure that their identity could not be linked to their particular responses. While this did preclude opportunities to interview any student about his or her own responses, the rapidity with which classroom teachers

needed to collect and process data between iterations of the same activity with successive classes limited the extent to which they were able to consider any form of data.

Some activities may lend themselves to providing alternative forms of information, such as students' worksheets completed during the lessons or traditional tests held at the end of the period. These occur in practice, but generally the processing, then contemplation of, such data is likely to require more than the 20 minutes of the teacher's time targeted in the criteria for this study. In addition, the provided information is likely to take the form of achievement levels rather than to focus on students' perceptions of activities. The SPAID package provided information to complement data from these other sources, and to do so it needed the freedom to differ.

Verification of responses: triangulation. The criteria considered important to establish the credibility of the SPAID package for teachers also inhibited the verification or triangulation of individual students' responses. Verification that students' responses authentically reflected their perceptions at the time was in part reliant upon care in the selection of the wording used to form the instructions and items of the instrument. Students and teachers from different areas of Brunei Darussalam read, interpreted, and discussed the intentions of the instructions and items (Table 3, Teachers F to K). Their conclusions were compared with the original intent, and indications of uncertainty necessitated closer examination of the wording and alternatives were investigated.

There were two levels of credibility of students' responses that interested teachers to different degrees. First, the responses for each individual student, and second, the responses for a class as a whole. Individual students' responses could

have been verified through comparing their Likert-type responses with their written responses to the open-ended item at the end of the survey. However, students did not necessarily provide applicable comments, in which case teachers were reliant on their interpretative-qualitative assessment of students' responses.

The main interest of teachers was at the class level rather than individual level, as they had limited time in which to consider and establish alterations to activities that benefited as many students as possible. While teachers would have preferred all students to have given an open-ended response at the end of the survey, they considered there to be adequate information without the written comments to provide some indications of students' perceptions towards the activities, with the written comments providing a bonus.

SPAID provided teachers with indications of trends in the reactions of a class of students to an activity, which assisted their identifying alterations in the activity that might improve it when used with other classes. Teachers were looking for rapid indicators to foster decisions that may improve classes' learning. The bulk of their interest lay in the general responses of classes as whole entities, notably, in regarding the central locality of responses to characteristics. If the responses for the majority of the class were similar then the teacher had reasonable verification that the responses were genuine. Identification of isolated instances or outliers at variance with those of the remainder of a class was easily achieved through viewing the graphical displays of responses to individual items. Such instances do provide opportunities for further investigations through case studies but these were not of interest to teachers in this study. Also, an even scattering of responses presented teachers with feedback from which they could glean little definite information to improve the activities.

Dependability: Reliability

This section considers the level of dependability or reliability of the results obtained using the SPAID package. Reliability in the traditional sense suggests the existence of a single reality that is possible to repeat (Merriam, 1998). However, repetition of the same activity with similar groups of students within even a short space of time can produce differing outcomes. Mutable influences from a myriad of factors, together with the variability of human behaviour, confound the establishing of clear causes and outcomes, thereby precluding exact replication of students' and teachers' responses.

Lincoln and Guba (1985) offer that the issue of reliability should be directed towards the "dependability" or " consistency" (p. 288) of the results from data, concentrating on whether the results make sense in relation to the milieu in which data were collected. Techniques to achieve this include outlining the investigator's position and verification or triangulation of findings and decisions (Merriam, 1998). These merge with the considerations of credibility or internal validity that were described in the previous section.

A further means of enhancing dependency is through providing an audit trail of findings. Since the nature of human behaviour precludes true replication, "the best we can do is to explain how we arrived at our results" (Dey, 1993, p. 251). This required explanations of how data were collected, how the categories were derived, and how decisions were obtained (Merriam, 1998). Teachers throughout this study were approached directly in person rather than formally through authority figures. This was to enhance the credibility of data and to limit any acquiescence-to-authority bias. Responses by contributors tended also to be informal, these being the most comfortable means for them. To attempt audio or video recording of contributors'

responses would have been inappropriate, as this would have added artificiality to the responses. Few written records by respondents were received, requiring my recording of responses as soon as possible after discussions.

Teachers will engage in, then iterate, an activity with classes if they believe that the activity is worth doing and they are given the opportunity to use it. Consequently, consideration of reliability or replication in this study necessarily turns towards the ability of the SPAID package to provide teachers with data and conclusions that they consider to be applicable beyond the initial situation.

Transferability: External Validity

The concept of transferability supplants traditional external validity in this study and refers to the application of the results from one situation to other situations (Merriam, 1998). This was central to the evaluation of the SPAID package, the purpose of which was to assist teachers to transfer outcomes from the use of an activity into alterations that improve its use in other situations. Possibilities could be either to increase the efficacy of the same activity with other classes, or to improve the impact of a different new activity with the same group of students. Two levels of transferability were considered. First, the intra-teacher level in which a single teacher would consider improvements within his or her own private sphere, and second, at the wider inter-teacher level in which improvements of activities may be passed from one teacher to another.

Intra-teacher. Results from the SPAID package were intended to be highly applicable within each teacher's personal approach to teaching. The existence of differences between students' and teachers' perceptions of the same situation are recognised in literature (Wildy & Wallace, 1994; Wubbels, 1993) and the SPAID package aimed to provide teachers with timely indications of these differences in

areas of interest to the teachers. This knowledge could then be included when considering alterations to improve the use of the same activity with other classes, or other activities with the same class.

Teachers' conclusions may be considered as a "working hypothesis" (Cronbach 1975, p. 125), in which the context plays a central role. The SPAID package contributed to teachers developing a perspective of a situation rather than the truth that positivism seeks (Patton, 1990). These reactions then develop over time for each teacher as he or she engages different student groups with different activities. Focus for this study was on assisting small incremental changes that are buried in the daily and mundane process of teaching, through which larger educational changes may be effected (Fullan & Hargreaves, 1992; Goldenburg & Gallimore, 1991).

Inter-teachers. Much of the understanding a teacher has following engaging a class in an activity can be tacit and personal. The idiosyncratic makeup of this understanding restricts the ability to relate benefits to other teachers, and this lies behind criticism of some aspects of the working hypothesis concept (Donmoyer, 1990). The SPAID package was designed to help individual teachers to improve the efficiency of their own delivery of activities, and hence improve the quality of the teaching and learning that occurs within the spheres over which they are able to have some personal control. Attention in this study was on intra-teacher development rather than inter-teacher development. While the enthusiasm of a teacher for an activity may encourage other teachers to explore the activity, this was not the prime intent of this study.

Although inter-teacher transferability was not the focus of this study, teachers do need to be aware of the potential for the SPAID package to provide information

that may be transferable to other teachers. Merriam (1998) listed three strategies to enhance the generalising of results and these were used in this study; *rich description*, *typical category*, and *multisite design*. Rich description involved describing the use of the SPAID package to allow readers to establish similarities between the study situation and their own situation. Illustrated uses of the SPAID package are provided in Appendices C and D of this study. They comprise a typical category (Appendix C), in which the situation exemplifies the activities in which teachers in Brunei are encouraged to engage classes, and a multisite design (Appendix D) that demonstrates potential diversity of the SPAID package.

Data Collection

Throughout the collection of data during the development of SPAID, I was highly cognisant of the cultural environment in which they were gathered. The possibility of respondents tempering their responses to conform to what they believed to be reactions preferred by those in higher hierarchical positions had the potential to influence the collection of realistic and honest data, and has been referred to in this study as the acquiescence-to-authority bias. Whether this bias was real or imaginary, steps to limit its influence were considered more important than the limitations such measures produced. The teachers I approached for initial suggestions for characteristics held positions of higher standing than I held in the education hierarchical structure. In this way their suggestions ran counter to any acquiescence-to-authority bias that may have existed. These approaches to teachers were also at a personal level rather than through authoritarian channels, and a strong emphasis was placed on the voluntary nature of their participation. Any influence of the

acquiescence-to-authority bias in students' responses to the survey was limited through the full anonymity of their responses.

The credibility of information obtained through the SPAID package was enhanced by the time that was spent establishing the instrument's characteristics. Initial responses were from teachers who had considerable experience and expertise in the educational environment of Brunei Darussalam government schools. Their views had been accumulated through prolonged engagement and persistent observation (Guba & Lincoln, 1989) in the relevant environment. Experienced teachers and educators knowledgeable of the Brunei education milieu peer-evaluated the decisions that led to the formation of the five characteristics. This began a constant accumulating cycle of confirmation and member checks (Guba & Lincoln, 1989) as conclusions were returned to those who had contributed them for confirmation, correction, elaboration, or general comment.

The processing and presentation of data were considered important to establishing the viability of the survey with classroom teachers. Generic distribution of computers installed with the Microsoft Excel program throughout government secondary schools in Brunei Darussalam opened the opportunity to use standard features within Excel to record, process, and display the responses.

Trial of SPAID

Data pertaining to the trials of the SPAID package were gathered through semi-structured interviewing of teachers, using a predetermined list of open-ended questions (Appendix H) as an interview guide (Merriam, 1998). These focused teachers towards the use of the SPAID package in their reflection of the activity, and led on to further comments and questions about SPAID as part of the continual questioning and reevaluation of results. Teachers discussed their responses to the

questions with me, and when I was the teacher who undertook the activity with a class I discussed my own responses to the questions with another teacher. The list of questions was given to teachers prior to interviewing so they could consider their responses and record them, either in writing or by electronic means.

Statistical Analysis: Visual Interpretation

Forming the Instrument

Two scenarios existed regarding the selection of a classroom environmental instrument for use in this study. The first and preferred option was for an existing educational environment instrument to be considered suitable, thereby opening opportunities for international comparisons of data and contributing to cross-cultural knowledge (Fraser, 1998a). This did not occur, as the established instruments (Appendix B) provide indications of classroom and school environments too general for the nature of interest that teachers had in students' reactions to specific activities. Also, the criteria established to enhance the practicality of the SPAID package for teachers limited the appropriateness of established instruments. Criteria such as minimal disruption to routines, processing and consideration of data requiring fewer than 20 minutes, and ready presentation of data in an easily understood format, were not satisfied by the established instruments. Time requirements for obtaining and processing data through the existing instruments were regarded as being too excessive to warrant consideration following engaging a class in an activity. Although there were many advantages to using an existing instrument, either in whole or part, indications pointed to the need to establish a new instrument.

Absence of an appropriate existing instrument for use in this study led to the second and less desirable option of forming a new instrument. A standard approach

when establishing educational psychosocial instruments is to investigate responses to a number of items. Statistical correlations of these responses then dictate which items are retained and into which scale or domain they are assigned. Applying these statistical measures presented several obstacles in this study and the traditional path was not followed for two reasons. The first related to the specific and small-scale nature of teachers' interests in the development of individual activities, and the second came from teachers' reactions to the determination of scales through statistical measures.

The study aimed to provide teachers with data that related to one class of students' reactions to an activity. The teacher would then consider these responses and alter the activity to reflect the expected reactions for a different group of students when they would be engaged in the activity. This procedure encompasses constant changes in the student composition, the activities, as well as the general conditions under which the teachers engage the groups of students in the activities. Sets of results relate to idiosyncratic conditions and a change in any of the conditions may produce a change in the teachers' reactions to the information available through SPAID. Every set of responses has the potential to produce a different pattern of correlations between items, so any attempt to establish a single pattern out of the items was expected to develop into an unwelcome and complex quagmire.

Inherent in the small-scale nature of teachers' interest is the small number of students' responses a teacher can expect from each use of SPAID. The number of students whose responses could be combined at any one time was limited to those from one class. Presentation of even the same activity to similar student cohorts within an hour was expected to alter as teachers adapted presentations to reflect both the information gathered via the SPAID package and their own impressions of the

differences between the groups of students. Each set of responses by a class was in reaction to differing activities.

Obtaining large sets of data through combining responses from different classes was possible and an example is included in Appendix D. However, this provided a broader view of students' perceptions than the specific nature that the study originally intended. On the occasion cited in Appendix D the teacher was looking for indications of students' overall perceptions of a project that involved several activities and he considered the loss of detail quite acceptable.

The second and more persuasive argument for not using statistical analysis of the items in the development of the instrument for this study came from the teachers themselves. They were interested in obtaining information about students' reactions to the activities. When the concept of statistical analysis of items arose there was distrust whether the end result would be apposite to their initial desires. Teachers expected that the characteristics of interest that they identified were not disjoint, having many aspects in common, and any attempt to isolate the characteristics was viewed with suspicion. This study was designed for classroom teachers, who were to be central to decisions made throughout the development of any instrument and analysis of data (Kyle et al., 1991). Consequently, statistical analysis through correlating items did not occur. In recognition of the indistinct barriers between the groupings of items, the term *characteristic* has been used to describe these groups rather than *scale* or *domain* as is commonly used with statistically identified independent groupings in established instruments.

Visual Interpretation

Teachers were expected to be more willing to consider using SPAID as part of their teaching routines if the time required to obtain and process data were

minimal (Fraser & Fisher, 1983a,b). Any analysis of information needed to comply with the criteria that were established to enhance the credibility of the study for practising teachers and the use of graphical displays of data played a central role in achieving this. Any analysis of data by a teacher had to be rapid, so forms of visual data presentation through graphs were used, utilising the ability of the human mind to analyse pictorial representations. Differences between the mean of students' responses to each characteristic and teachers' expected value were readily identified, indicating areas of further interest to teachers. The time criterion for processing data was 20 minutes. Within this timeframe teachers were to be able to organise and process the data, consider the students' responses, and develop conclusions that might lead to possible alterations in the presentation of the activities with other classes.

Summary

This chapter outlined the method and decisions that led to the development of the Students' Perceptions of an Activity Instrument and Display (SPAID) package. Embedding the study within the reality of the teaching and learning milieu of government schools of Brunei Darussalam was essential throughout the study and had significant impact on the methodology.

Experienced teachers identified five characteristics of interest to them, and these then formed the focus for the instrument. A set of criteria was established to enhance the viability of the study for practising classroom teachers. These were pragmatic concerns, and included limiting the time requirement for administration and processing, teachers' voluntary participation and avoidance of authority-directed participation, and student anonymity. Linguistic considerations led to the production

of two student versions of the instrument, one in Bahasa Melayu and the other in English. A teacher version in English paralleled the student version. Linguistic considerations led to the use of simple and direct sentences with a preference for positive items rather than negative. Data processing and display utilised the Excel spreadsheet program that was readily available to all secondary schools in Brunei Darussalam.

Steps taken to improve the credibility, dependability, and transferability of the SPAID package for practising teachers supplanted traditional discussions on validity and reliability. This conformed to the nebulous nature of data from human behaviour.

Chapter 4 outlines the results obtained throughout the study, first considering the stages of instrument development, and then the outcomes from using the SPAID package. Prominent amongst these are results noted in two contrasting applications of SPAID that are covered in more detail in Appendices C and D of this study.

CHAPTER FOUR

RESULTS

Chapter Four presents the results that led to the development of the Students' Perceptions of an Activity Instrument and Display (SPAID) package and the evaluation of teachers' reactions to their use of SPAID. The chapter is comprised of two parts. The first presents answers to the first three of the four research questions posed in this study:

1. What are the perceptions of students that teachers of mathematics and science in Brunei Darussalam consider pertinent in their evaluation of new activities with classes?
2. What instrument will provide relevant student perception information?
3. What presentation of student responses to the instrument do teachers consider readily serviceable?

It begins by identifying the five characteristics of students' perceptions that teachers considered of interest at the conclusion of an activity new to either the students or themselves. An outline of the development of the survey within SPAID follows, and finally considerations pertaining to the display and presentation of that data are discussed.

The second part of Chapter 4 presents results that suggest answers to the fourth research question:

4. What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?

Evaluation of the outcomes observed when teachers used the SPAID are provided, with particular reference to two contrasting situations that are outlined in

Appendices C and D. Appendix C outlines the use of the SPAID package to improve my use of an outdoor trigonometry activity with more than one of my normal teaching classes. In contrast, Appendix D outlines the use of the SPAID package to support a group of teachers' assessment of a series of innovative environmental activities with a new group of students.

Part 1: Formation of SPAID

Data Collection

Teachers. Five teachers experienced at working within the Brunei Darussalam education environment were canvassed for students' perceptions that they considered would be of interest to them following the use of a new activity with a class (Table 3, Teachers A to E). Four of the teachers were heads of departments, and the fifth was a school inspector for the Ministry of Education. Their submitted contributions are provided in Appendices G1 to G5 and a summary of their responses arranged into characteristics is provided in Appendix G6. The balances between Brunei and non-Brunei teachers, and the male and female teachers who contributed initial ideas were considered to represent the proportions of teachers likely to be teaching mathematics and science in classrooms. Numbers of teachers in Brunei Darussalam employed by the Ministry of Education are given in Table 1. School administrators and officers attached to the Ministry of Education are usually drawn from the ranks of local teachers, and this increases the proportion of expatriate teachers amongst those who teach in classrooms.

Confirmation of Characteristics

The comments supplied by the five experienced teachers concerning students' perceptions were compared with the learning aims of secondary education published

in examination syllabi for lower secondary (Curriculum Development Department, 1994) and upper secondary (University of Cambridge Local Examination Syndicate, 1996), and later to a study on the concerns of Brunei secondary school teachers (Wong et al., 1998; Wong et al., 1999). Five categories of student interest were established from their responses and are listed in Table 5. The list of the consolidated characteristics was shown to the five contributing teachers for comment, as well as to fifteen other teachers from English, geography, and mathematics. All teachers responded verbally that the five characteristics appeared suitable and none added further characteristics.

Table 5

Brief Descriptions of the Five Characteristics Measured by the Survey

Characteristic	Brief description
Understand Content	How well students consider the activity helped them to understand the content
Communication	How well students consider they understood the instructions for the activity
Relevancy	How relevant students considered the activity
Work Output	How hard students think they worked
Enjoyment	How enjoyable students found the activity

Interrelated characteristics. The effectiveness of categories gleaned from qualitative data is enhanced when they are mutually exclusive (Merriam, 1998), which is suggestive of a series of divergent relationships. In this instance the teachers were acutely aware of the potential for strong interrelationships to link the five characteristics but were still interested in obtaining general indications of them.

Audit trail. The teachers were certainly willing in their contribution of ideas but their verbal confirmation of data made it difficult to establish an audit trail of written artefacts. Confirmation of the five characteristics occurred either through telephone conversations or face-to-face discussions. The five experienced teachers who contributed the initial ideas for characteristics were willing in their discussion of the characteristics when presented with the five characteristics (Table 5), but none provided further written responses beyond those in Appendices G1 to G5.

Descriptions of the Five Characteristics

This section contains extended descriptions of the five characteristics of student perceptions considered of interest by teachers.

Understand content. Understand content related to how well students considered the activity helped them to understand and recall the content required for the activity. Under normal conditions students could expect the content to be directly linked to the examination syllabus and to be the subject of traditional testing that requires understanding and recall.

Communication. Communication referred to how well students believed they understood the spoken and written words used within the instructions. Teachers promote learning by clearly communicating to their students what is expected and why (Porter & Brophy, 1988; Fraser & Tobin, 1989a), with verbal interaction to monitor student understanding of science and mathematics being considered a key issue to teaching with understanding (Fraser & Tobin, 1989a). The Brunei Ministry of Education employs teachers from a wide variety of ethnic and national origins. The varied usage of English vocabulary, accents, and speeds of delivery by teachers and students present considerable propensity for difficulties in understanding to occur during verbal interactions.

Teachers who do attempt new activities with classes can be expected to put considerable effort into clarifying the instructions for students. In the limited verbal communication environment of Brunei classrooms it can be difficult for teachers to establish the level of success of their communication efforts. Timely awareness of students' difficulties with instructional language would enable teachers to reconstruct their delivery of instructions.

Relevance. Relevance related to whether students considered the activity to be relevant to their learning. This was applied at different levels. Teachers engage students in activities for a range of reasons, from illustrating a specific point of content through to providing enjoyment, or simply to provide variation from class routine. The importance of the emphasis on examinations in the Brunei education system cannot be underestimated and the relevance of class activities towards this form of assessment was a central interest for responding teachers. Relating the activity to the subject generally, as well as to the world outside the classroom, was considered desirable. Relevancy was therefore considered to apply at three levels; the first allowed students to assign their own interpretations of the word "useful" and did not apply any restrictions, the second considered the school subject generally, and the third specifically focused on tests and examinations.

Work output. Work output considered the effort and willingness with which students engaged in activities. A standard phrase used within Brunei school societies, "Try my best", encapsulated much of the feeling behind work output. Teachers mentioned in discussions that they assumed that their students' efforts were commensurate to their willingness to undertake the activity as well as the degree to which students believed the activity to be useful, albeit within the framework of

examinations. Whilst agreeing that at times this may be in error, it was deemed to be a likely combination.

Enjoyment. Enjoyment of activities by students was of interest to teachers but tended to remain secondary to test and examination interests. Teachers believed that if students enjoyed an activity or task then they were likely to achieve better outcomes than if they disliked the activity. Generally these outcomes were related to test and examination percentages, though there were comments suggesting the improvement of students' attitude towards their subject extending beyond school as a long-term goal. Enjoyment provided perhaps the best example of teachers expecting considerable connections between the five characteristics.

Omission of Parents

The reaction of parents to activities was mentioned by two of the experienced teachers (Appendices G1 and G3) but was not included in the characteristics for the instrument. Parents have an important role and status in the hierarchical Brunei society in which their opinions are highly valued. The intent of the study was to obtain reactions of students to an activity, and to have included items asking for students' perceptions to what they thought their parents' reactions might be was deemed to be diluting the direct nature of the survey. It was considered that the most likely route for parents to be informed about an activity would be via the expressed reactions of their own children at home. Obtaining students' reactions directly was expected to circumvent delays in receiving parents' comments.

This decision to omit items that focused on parents' reactions was supported by their limited role in the operation and running of schools in Brunei. It is unusual for parents to meet teachers other than at the school parent-teacher meetings that might operate a couple of times a year. There are no Boards of Trustees or Parent-

Teacher Associations that have administrational responsibilities to schools' operations. Consequently, although the importance of parents' reactions was recognised, items with this focus were not included in this study. Support for this decision later came from a survey of the concerns of teachers in Brunei (Wong et al., 1999) in which concern from demanding parents showed to be the lowest-equal concern.

Forming Survey Items

Fourteen existing instruments (Appendix B) were considered for suitability with regard to the five characteristics identified by experienced teachers. While several instruments contained items that lent suggestions, neither a single instrument nor a scale within an instrument was considered appropriate for use within the Brunei setting. Items that contained possible ideas were listed under the applicable characteristics (Appendix I). Concepts for three items in each of the five characteristics were established.

Language versions. Each concept was discussed with a local teacher who provided the initial draft of a local language version. This was a difficult task due to inconsistencies between the concepts expressed in English and their formation in Bahasa Melayu. Several factors influenced the vocabulary. It was considered neither possible nor desirable to specify the nature of the activities in which teachers may wish to engage students so items in the survey needed to be sufficiently flexible to cover a range of activities.

Simpler expressions and constructions were preferred to expressions that although could be considered to be more accurate, were more complicated. Translation of the word "useful" provided an example, as two options were available. *Berguna*, as a simpler term, was considered to be readily understood by students at

all levels in secondary schools in Brunei. Although the translator considered *berfaedah* to provide a more accurate translation for the survey, he considered there might be some students, either of a young age or limited linguistic ability, for whom the word may be unfamiliar.

The possibility of a time delay between students completing the activity and completing the survey also influenced vocabulary. The activity could occur out of school time and involve students' actions independent of the teacher. Completion of the survey may therefore have occurred days later. In the absence of the definite article *the*, decisions between using *ini* (this) or *itu* (that) were based upon such temporal considerations, as well as which sentence structure students would find more comfortable, or simply "sounds better". Some minor alterations of the concepts were involved to accommodate linguistic considerations that the local teacher considered students in Brunei would find more familiar. The items in Bahasa Melayu were translated into English and a draft of these was shown to seven colleagues teaching English to secondary students in Brunei (Table 3, Teachers M to S). Their understanding of students' English knowledge led to a few minor changes to the English version of the survey. The two linguistic versions were then shown to five local teachers (Table 3, Teachers G to K) for comment. Dialectic and other minor differences decided through showing options to two groups of students; one class of 26 Form 3 science students, and one class of 18 Form 6 mathematics students. A final back-check was conducted by a local female Deputy Principal who had considerable facility with both Bahasa Melayu and English (Table 3, Teacher L).

I was totally reliant on my local teaching colleagues for the production of the Bahasa Melayu version of the survey. The system of checks and back-translations and the minimal differences noted indicated the translation to be satisfactory. The

resultant items and translations are listed in Table 6. Items were cycled through the characteristics to form the survey used in this study (Appendix A). Students who completed either version of the survey during this study did so without requesting clarification of either the instructions or the items, further indicating that the translations were satisfactory.

Table 6

Items Assigned to the Five Characteristics of SPAID

Category		Items
Understand content	1U	Aktiviti ini menolong saya memahami apa yang perlu saya pelajari. The activity helped me understand what I need to learn.
	6U	Aktiviti ini dapat membantu saya untuk menerangkan kerja ini kepada kawan saya. This activity would help me explain the work to a friend.
	11U	Aktiviti ini akan membantu saya membuat persedian untuk menghadapi ujian. This will help me remember what I need to know for my tests.
Communication	2C	Saya faham arahan yang diberikan oleh guru itu. I understood the instructions that the teacher gave.
	7C	Saya faham bagaimana saya harus melakukan aktiviti itu. I understood how I had to do the activity.
	12C	Saya keliru mengenai apa yang perlu kami buat dalam aktiviti itu. I was confused about what we were to do in the activity.

(table continues)

Category		Items
Relevancy	3R	Aktiviti ini adalah berfaedah bagi diri saya. The activity that I did is useful.
	8R	Aktiviti ini dapat membantu saya dalam matapelajaran ini. The activity I did will help me in the subject.
	13R	Aktiviti tersebut berguna untuk saya mengadapi ujian. What I did in the activity is useful for doing tests.
Work output	4W	Saya sudah mencuba sedaya-upaya saya membuat kerja itu. I tried my best to do the work.
	9W	Saya rasa gembira membuat kerja itu kerana ianya berguna. I was happy to do the work because it was useful.
	14W	Saya mahu membuat kerja yang diberikan seperti aktiviti ini. I wanted to do the work for this activity.
Enjoyment	5E	Aktiviti yang saya buat itu menyeronokkan. I enjoyed doing this work.
	10E	Saya suka membuat lebih banyak aktiviti seperti ini. I want to do more work like this.
	15E	Aktiviti ini menjemukan. The activity was boring.

The effort to establish the two linguistic versions was vindicated through the numbers of students who opted for the Bahasa Melayu translation when responding to the survey (Appendix F). The proportion of students who responded using the Bahasa Melayu version of the survey decreased as the level of the class increased. 72.5% of the Form 4 students in Appendix C used the Bahasa Melayu version while 14.1% of the pre-Form 6 students in Appendix D used the Bahasa Melayu version.

Negative items. The use of positive wording when forming the items was preferred as these provided simpler grammatical constructions (Taylor et al., 1995), thereby reducing confusion regarding the intention of the items and the time

required for students to respond to items. Adopting a positive approach was also thought to encourage students to consider the activities from positive directions, thereby encouraging teachers in their trials of new activities within a generally traditional educational milieu. However, two negative items were included in the instrument; item 12 used the word *confused*, and item 15 used the word *boring*. Students were comfortable with both of these words and attempts to present these two items with positive orientations presented unacceptably convoluted linguistic constructions in both the Bahasa Melayu and English versions, especially when the various response options were considered. These two negative items were reversed scored and placed towards the end of the list to minimise promotion of negative reactions to the activities.

Face validity. Face validity of the items was established through showing the items listed in Table 6 to teachers who were well acquainted with the practicalities of teaching in Brunei secondary schools. The items were also shown to three lecturers of science and mathematics education at Universiti Brunei Darussalam. Discussion resulted in using essentially the same wording though with minor alterations in presentation.

Teacher Version

Teachers were given the opportunity to record their own estimates of students' responses through a teacher version of the instrument (Appendix A). Minor alterations to the items were made, as exemplified in Item 1:

Student version*:* *The activity helped me understand what I need to learn.*

Teacher version: *The activity helped students understand what they need to learn.*

Open-Ended Response Item

An open-ended item was included at the end of the survey to provide students with an opportunity to offer comments and suggestions regarding improvements to the activities that may not have been catered for in the survey. The wording was also subject to close scrutiny by teachers who possessed not only knowledge of both Bahasa Melayu and English, but perhaps more importantly, an appreciation of students' levels of comprehension and uses of vocabulary in both languages (Table 3, Teachers G to K). The stem for the item decided upon was

Saya rasa aktiviti yang kami telah buat itu akan lebih baik sekiranya…

I feel the activity we did would have been better if…

Willing responses. Students willingly responded to the open-ended item at the end of the survey (Appendix H), using the same language as that of the version of the survey they chose. A number of students did not provide comments, with the number increasing when the same cohort of students was engaged in a series of activities. Table 7 provides the number of students who wrote open-ended comments over the series of activities that constituted the SOAS Environmental Research Project (SERP) outlined in Appendix D.

Table 7

Numbers of Students from a Single Cohort of Students who Provided Open-Ended Responses through a Series of Activities

Order of activity	Students responded	Percentage
1st	16 out of 19 students	84.2
2nd	14 out of 19 students	73.7
3rd	5 out of 14 students	35.7
4th	7 out of 17 students	41.2
5th	4 out of 15 students	26.7

Students' open-ended responses tended to indicate whether or not they were in favour of the activity and touched on behavioural alterations, such as slower pace, more repetition of explanations, and stricter discipline.

Honest responses. The anonymity of responses appeared to benefit the acquisition of students' honest responses. I found that overt efforts to show that individual students' responses could not be identified were reassuring to those who were yet to submit their responses. These students then appeared more willing to pass forward their survey sheets. Efforts included looking the other way as students slid their responses into the pile and shuffling the papers in an exaggerated manner. Another useful method that demonstrated anonymity was for a student to gather the completed survey forms rather than the teacher.

The presence of minor criticisms within the students' open-ended comments suggested that at least some students were sufficiently comfortable with the anonymity for their responses to conflict with what they might be expected to provide should they be trying to please the teacher. While a few responses were considered as flippant, no student took the opportunity to include a comment that was viewed by teachers as inappropriate or offensive.

However, it must be recalled that students' acquiescence to teachers as authority figures is deeply ingrained in Brunei society. There was only one open-ended response that indicated a strong dissatisfaction for the activity (Appendix F7, Table 19, Student 22). For that student to have made the comment within the cultural milieu of Brunei Darussalam suggested considerable faith in the confidentiality of responses and the strength of the anonymity. Although teachers detected no evidence that students modified responses to conform to what they thought the teacher wanted,

there will always be an element of uncertainty that may limit willingness to accept the results at face value.

Linguistic Influences

Local Language Responses

Students who responded to the open-ended item in Bahasa Melayu when their teachers had limited knowledge of the language presented linguistic challenges. Enlisting the help of colleagues proficient in the use of the local language proved beneficial and encouraged collegial discussions that occur less in practice than desired. The teachers whom I approached to provide translations of students' responses proved to be supportive and interested in the activities I used. Providing translations was not necessarily an easy task and at times they needed to discuss students' responses with other teachers. Practising teachers in Brunei Darussalam generally have expressed little interest in participating in educational research (Wong et al., 1999). The provision of this translation service was an invaluable contribution to my efforts and may be a relatively easy introduction to research for teachers interested in contributing to the body of educational knowledge.

It might not always be possible to obtain translations of students' open-ended responses prior to considering alterations to activities. Sufficient time and the good will of a colleague were required, and should neither be evident, teachers had to restrict their consideration to those responses they could read. This consequence was regretted, especially as it was considered that those students who had difficulty communicating in English might have had significant comments to make. Teachers with an interest in developing an activity tended to allow considerably more time between iterations than the minimum of a single teaching period allocated in the

criteria for this study (listed in Chapter 3). Consequently, teachers were able to obtain translations of students' comments prior to engaging in the next activity.

English Responses

Students appeared to realise the difficulties that their foreign teachers would experience should their open-ended comments be in the local language and there were many laudable attempts to communicate open-ended responses in English.

Uncertain understanding of students' intent. Although students' responses to the open-ended item in English eliminated the need for teachers to obtain translations, their doing so did raise the issue of whether students were able to convey their thoughts accurately in English, which was at best their second language. Several factors conspired against teachers discussing with students the meanings of individual responses about which they were uncertain. These included the anonymity requirement that was considered to enhance validity of responses, the rapidity with which information from the survey was required on occasions, and the linguistic difficulties in communicating between teachers and students. Consequently, students' interpretations of items and the intentions of their responses at times remained unresolved and uncertain to the teachers. This was considered a realistic situation for classroom teachers in their normal praxes, adding a degree of uncertainty to any conclusions and was a recognised limitation to interpreting results.

An example of teachers being uncertain about a student's intention was provided by Student 17 from Appendix C (Table 8) who responded to the open-ended item "*I feel the activity we did would have been better if...*" with the comment: "they do not frequently". On such occasions teachers considered that the students had valid comments to make and the inability of teachers to communicate directly with particular individual students in their first languages was regretted. Requiring the

assistance of a colleague to translate responses from local languages into English provided the extra dividend of having a second teacher's opinion of the students' responses in English that were difficult to ascertain. In my case this supported my conclusions, especially in cases such as Student 17 above when we concurred that the meaning was unclear.

Data Display

The manner in which teachers were presented with data was considered important if they were to consider SPAID to be viable for use with their classes. Criteria for data compilation and processing were outlined in Chapter 3. Central to this was the need for the process to be simple and quick.

Hand processing. The requirements for this study to enhance the viability of SPAID for classroom teachers required that the information be compiled, considered, and acted upon within 20 minutes. I attempted manual collation and processing of students' responses for the two classes that engaged in the activity outlined in Appendix C. The times required for processing were 35 minutes for the first class and 30 minutes for the second class, both well beyond the 20-minute allocation. Transcription errors also occurred, as concentration was difficult to maintain amongst the daily operations of schools. Consequently, computer assistance was deemed necessary for timely information to be available to teachers.

Computers. Computers were used to collate students' responses to the Likert-type items and to present data. Choice of the program to use in the collation and processing of students' responses was simplified through IBM compatible machines and Microsoft programs being dominant throughout Brunei and common to all secondary schools in the country. The prevalence of the Excel spreadsheet program led to its choice for use in processing and displaying data. Automatic

graphing options within Excel were explored to meet the criteria established for the study, in particular, the need for the process to be simple, quick, and straightforward to analyse.

Linear graphs are common in educational environment literature, with Figure 4 in Chapter 3 being an example. Inaccuracies inherent in the common use of line graphs are given in Chapter 3, and other representations were explored in an effort to avoid hints of prioritised characteristics and interpolation of values. Bar graphs removed the suggestion of possible interpolation but they soon became cluttered when attempting to compare two or more sets of responses on the same axes.

Wubbels (1993) provided a notable alternative to linear graphs with his use of an octagonal chart to illustrate responses to the Questionnaire on Teacher Interaction (QTI) (Figure 3). An essential difference between displaying responses to SPAID and those for QTI is that SPAID sought a simple and easily understood display of students' responses to five differing characteristics, while the QTI diagrams involved two-dimensional interactions between two continuous scales. All display methods appeared to contain technical inaccuracies. The distinctive display of the QTI results inspired the idea of displaying the responses to SPAID characteristics as linear distances radiating from a central point.

Radar graph. My preferred automated graph within Excel was the radar graph, depicted in Figure 5. These are distinctive and also lessened some of the inaccuracies inherent in linear graphs and Wubbels' octagonal diagrams. Values for each characteristic are spaced evenly about the central point, the distance being directly proportional to the value for that characteristic. The automated feature is able to connect points, which assists comparison of sets of data and produces a spider web effect. This connecting facility was regarded to be a weakness as it suggested

interpolation, as did the linear graphs, but the interpolation and prioritising effects were considered to be lessened with radar graphs due to the non-linear display of the characteristics.

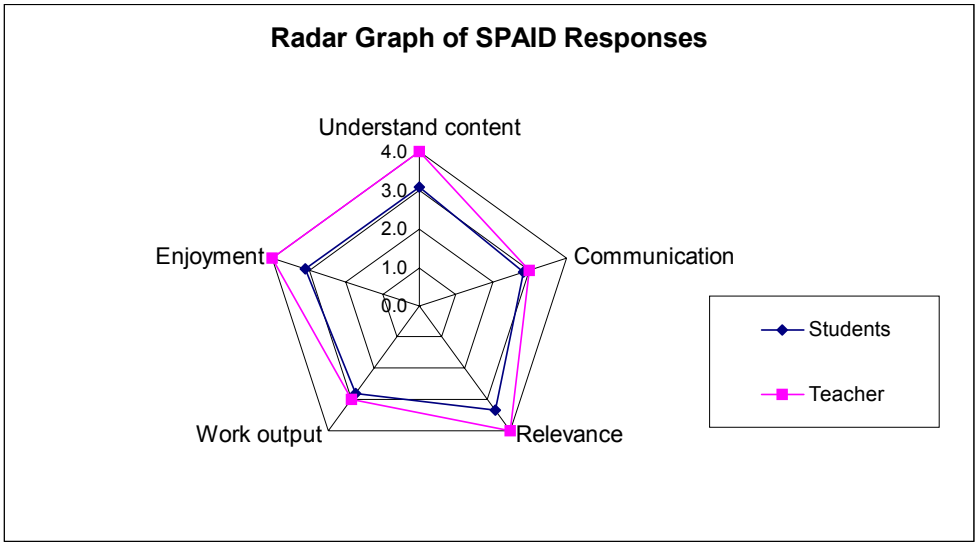


Figure 5. Example of a radar graph used to display responses from SPAID.

Line graph preference. Teachers were shown examples of radar graphs and in all instances required explanation of the display. Of the types of graphs investigated, the line graphs and bar graphs proved to be innately comprehensible to teachers. Consequently, in spite of mathematical inaccuracies and my own preference for the radar graph, choice of graphs returned to the line and bar graphs to display information in SPAID.

Data display. The use of the automatic computer-generated graphing features opened many opportunities to display students' responses. Discussions with teachers as to what features would be of interest resulted in the five-page graphing template, an example of which is given in Appendix J. Responses from the students and the teacher are entered on the first page of the template, providing a complete list

of the responses. The second page presents two line graphs showing the average responses for each of the five categories; one graph comparing students' responses with those of the teacher's estimates of their responses and the other comparing male students' responses with female. The third page provides bar graphs of collated totals for each of the five categories.

Limiting the number of items so the survey could be presented on a single side of A4 paper was considered a contributing factor for both students and teachers being willing to complete the survey. The small number of items (15) in the survey made it possible to display graphs of students' responses for each individual item, and these occur on the remaining two pages of the display. Page 4 displays the frequencies of responses for each of the 15 individual items. Figure 6 shows the display of students' responses for the characteristic Understand Content found in the example that comprises Appendix J.

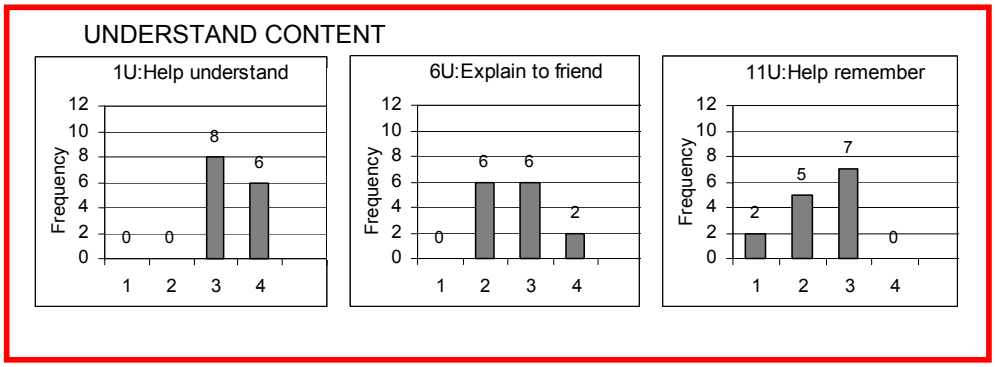


Figure 6. Example of SPAID page 4 display of students' responses to individual items within the Understand Content characteristic.

A study conducted in Brunei (Riah & Fraser, 1999) revealed gender differences in students' perceptions of classroom learning environments. This finding prompted the display of male and female responses to each item in SPAID, shown on

page 5 of the template (Appendix J). Figure 7 shows the displays of male and female students' responses for the characteristic Understand Content in Appendix J. The number of responses for each item was included at the top of each bar to remind teachers of the number of students involved.

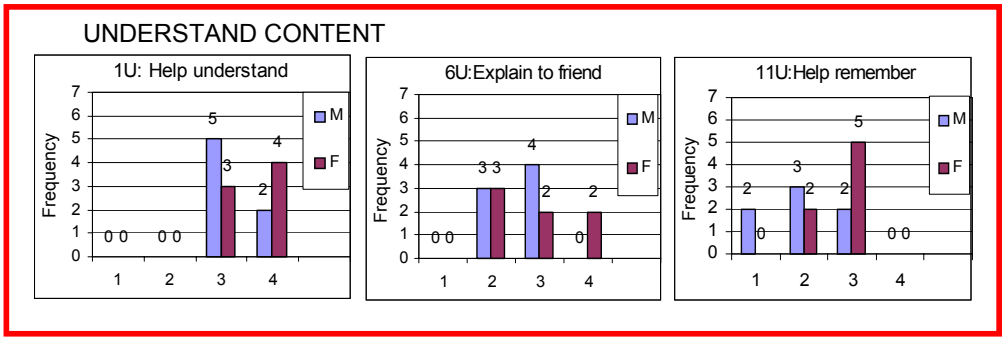


Figure 7. Example of SPAID page 5 display of male and female students' responses to individual items within the Understand Content characteristic.

Small n-*value influence.* The SPAID package provides teachers with indications of a class of students' perceptions of an activity, but carried the riposte that a small number of students greatly increased the impact an individual student's responses could have on general graphical impressions. One example of the influence occurred in the SOAS College Environmental Research Project (SERP) that is the subject of Appendix D, but occurred in one of the activities not mentioned in detail within that appendix. On this occasion a student's written comment referred to his forgetting to bring suitable footwear, which influenced his perceptions of that activity. His responses provided isolated low values for several of the items. The teacher was able to remove this individual's responses to obtain what he believed to be a more accurate impression of the whole groups' reactions to the activity per se. The SPAID template was sufficiently versatile to accommodate such considerations

with minimal effort on the part of the teacher. Identifying such instances that skew results is not always possible and it is accepted that there may have been other instances of influential individual students' perceptions being concealed.

Survey Criteria

Requirements to enhance the viability of the Students' Perceptions of an Activity Instrument and Display (SPAID) for practising teachers were given in Chapter 3. These included the need for the survey to be quick and easy to administer and process. The requirement to have the directions, items, and students' responses fit onto a single side of an A4 sheet of paper enabled the same sheet to contain both student linguistic versions of the survey. All of these criteria were satisfied with the survey and automated graphing template that comprise the SPAID package.

Students required an average of less than ten minutes at the end of class time to complete their responses to the survey (Appendix F) and no student asked for clarification of any instruction or item from a teacher. This period of time proved useful for the teachers who used the time to complete the teacher version of the survey or to collect and order equipment used in the activities. Students who were engaged in several activities for each of which they completed a SPAID survey, were noted to have pre-empted their responses to several items (Appendix D). They were observed responding to specific items in the Survey rapidly and out of numerical order, possibly those in one characteristic, then to return to the beginning of the list of items to respond to remaining items at a slower pace. By this time the students required fewer than five minutes to complete the survey. One view of the rapid completion of the Survey is that students rushed items in order to get it over with as fast as possible. If this were the case then I would have expected all items to have been worked through rapidly in order. However, these students targeted certain items

and then returned to complete the list. This indicated to me that some students had reflected upon their participation and roles whilst engaging in the activities, or at least soon after completing them.

Page 1 of the display has space for the responses for up to 40 students per class, since teachers considered it unusual for a class size to exceed this number. Entering the responses from a class of about 20 students into the Excel graphing template and reading the open-ended responses that did not require translation was found to require about twelve minutes (Appendix F), the length of time decreasing as the teacher became more familiar with the template. If adhering to the criterion of 20 minutes for processing and consideration of students' responses (as outlined in Chapter 3) this left approximately eight minutes for teachers to view the five pages of displays and develop alterations to the activities.

Teachers required fewer than 5 minutes to absorb the general shape of the data and to begin considering alterations. They quickly developed an understanding of the graphical data and had little difficulty merging the students' open-ended comments to develop interpretations of students' reactions to the activities.

Summary Graph Focus

All teachers sought a simple and rapid indicator of students' reactions to their activities. The Page 2 summary graph that compared students' responses with teachers' own estimates of students' responses was of greatest interest. This, together with the students' open-ended comments, appeared to provide a sufficiently general and succinct overview to satisfy teachers' initial curiosity. Graphs of individual items tended not to be viewed in more than cursory detail unless teachers considered differences between students' and their own perceptions to be sufficiently significant to warrant interest, as occurred with the biology teacher in Appendix D.

The criteria established to improve the viability of the SPAID for practising teachers in government schools of Brunei Darussalam appeared to have been satisfied. Establishing whether or not the SPAID was a functional tool for providing the information of interest to teachers required using it with classes. The second part of this chapter presents teachers' uses of SPAID in practice.

Summary of Responses to the First Three Research Questions

Succinct summaries of responses to the first three of the four research questions for this study are as follows.

Question 1: What are the perceptions of students that teachers of mathematics and science in Brunei Darussalam consider pertinent in their evaluation of new activities with classes?

Response: Teachers were interested in five characteristics; Understand Content, Communication, Relevance, Work Output, and Enjoyment.

Question 2: Is it possible to establish an instrument that will provide relevant student perception information?

Response: A search of a number of existing instruments (Appendix B) indicated the need to establish a new instrument, a copy of which is provided in Appendix A. Two student versions were formed, the first in Bahasa Melayu and the second in English, while one teacher version in English paralleled the student versions.

Question 3: What form of presentation of student responses to the instrument do teachers consider readily serviceable?

Response: A computer template was constructed to process responses to the survey and to provide automatically generated graphs to display the numbers of responses. An example is provided in Appendix J. The combination of the survey

and the computer template was labelled the Students' Perceptions of an Activity Instrument and Display (SPAID) package.

Part 2: Using SPAID

The second part of Chapter 4 considers teachers' reactions to the information available through SPAID and presents results towards answering the fourth research question of this study:

Question 4: What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?

The section begins with observations that teachers provided, and includes the benefit of having a structure for reviewing activities, the presentation of timely data to compare with their personal impressions, and the reminder to reconsider the activities from the perspective of the students. The section continues with observations of teachers' reactions to data, and includes the continued importance of the bias of teachers' beliefs in the activities, the ability of the SPAID process to be a catalyst for change and to promote cooperation amongst teaching colleagues.

Structure to Review

A common reaction from teachers was that SPAID provided a timely structure for them to reconsider their activities. Even simplistic outcomes provided a point from which teachers were able to start considering alterations to improve the effects of activities.

Independent of teacher. Students were able to complete the survey regardless of the teacher being present while they responded to the items. This proved beneficial during the activities mentioned in Appendix D where the need for

teachers to teach other classes at times prevented their attendance throughout the entirety of the activities they established for students.

Timely Provision of Data

The rapidity with which the information was available for consideration was considered a highly potent aspect of the SPAID package and led to several positive outcomes. Advantages to considering alterations to activities were similar whether the wait before iteration of the activity was a day or a year.

Fading recall. Teachers' recollections of their own impressions whilst engaging a class in an activity faded rapidly. Considering the students' responses as soon as possible after completing the activity limited the impact of time obfuscating teachers' impressions. The biology teacher in Appendix D expected a year to elapse before her activity might be repeated and she found the luxury of abundant time an equivocal advantage. She believed that considerations of events through SPAID provided a timely and written record of her impressions of the activity, which had already begun to fade when we discussed her reactions to the SPAID information two days after the activity. The recorded responses were expected to prove valuable during preparations to repeat the Project. Without these records the teacher expected to be reliant on her own faded impressions. As a result the significance of many concerns and issues could have greatly abated.

Alleviation of concerns. Teachers who engaged in activities that varied from traditional and expected approaches to teaching were apprehensive regarding the consequences of possible student disaffection. The Orientation activity described in Appendix D is an example. Prompt provision of students' reactions alleviated the influence of these initial concerns, in many cases permitting the teachers to continue with greater confidence and bolstered enthusiasm.

Maturing conclusions. Providing teachers with rapid feedback of outcomes enabled them promptly to begin considering potential alterations. This was found to be useful even when there was an expected delay of a year before the activity might be repeated. Ideas were then given as prolonged a period of time as possible to mature.

Impelled Review and Altering Perspective

Teachers admitted that although they appreciated the necessity to review all teaching as part of normal praxis, to do so is sometimes difficult. They agreed that time should be made available to pause amidst the rush of school life, to consider the actions and reactions that have occurred, and to realign their thinking. Through completing the teacher version of the survey the teachers found they were well advanced to achieving this. Presenting the teachers with graphical displays increased their impetus to delay becoming embroiled in other daily activities of teaching and to consider students' responses.

Teacher Bias

Teachers' beliefs remain influential. All teachers who used the SPAID had instigated the activities under their own initiatives, and so had high levels of interest in the worth of those activities. This introduced teacher-bias towards the activities, which could have influenced their reception and reactions to students' responses. Teachers may have inferred students' responses that contained a degree of ambiguity in a manner sympathetic to their own bias. The response to the open-ended item by Student 13 in Class 2 of Appendix C (Table 9) was translated as "do it well". Two contrasting interpretations were possible. Student 13 may have meant that if he had carried out the activity well he would have benefited more than he did, implying that he should have made a greater effort. A different interpretation may have been that

"do it well" implied that I, as the teacher, needed to improve my own performance. At the time my preference was to the former of the two interpretations.

Whilst differences between students' and teachers' responses to the survey were valued as alternative perspectives of events, they did not negate the bias teachers brought. I believed the Trigonometry activity in Appendix C conformed to calls for practical applications of mathematical concepts, yet I was reluctant to spend more than a single teaching session with students in a location outside the classroom where they did not expect to be. This accompanied my belief that students and school authorities expected the class to complete the syllabus and to remain parallel with other classes undertaking the same course. These beliefs influenced my decisions after consideration of SPAID results.

There were no examples of the responses by students being widely divergent from their teachers' corresponding estimates, so the teachers' reactions under extreme cases remained untested.

Opening activities to criticism. Opening activities to potential criticism from students was not an easy task for the teachers. They could be expected to be defensive of their own ideas, which would have influenced their reactions to students' responses. Whether teachers ever take sufficient notice of students' reactions is arguable. An example from the Orientation activity (given in Appendix D) was the teacher's reaction to two students' comments that the walk was too long. His view was that the students lacked exposure to jungle walking and similar activities (Appendix H2). The teacher's personal preference towards undertaking walks in the jungle was evident and it was unclear as to the number and strength of students' responses required before he would have considered shortening the route. Following the review of students' responses the teacher intended to retain the route

for the following year. However, the SPAID results had planted the idea of a possible route change, which would remain with him throughout the year.

Tentative underestimation. Teachers were generally conservative in their estimations of students' reactions to activities. This appeared to counter findings that teachers tend to consider educational environments more favourably than their students (Fisher & Fraser, 1983a; Gervasoni, 1994; Raviv, Raviv, & Reisel, 1990). Uncertainty as to the reception of activities by students and other interested groups contributed to teachers underestimating students' responses. Teachers involved in the SERP of Appendix D were engaging in highly experimental activities within the Brunei educational system and students' reactions to activities were unpredictable prior to the first activity. The teachers were constantly wary of adverse reactions that may have had detrimental effects on their project and apprehension contributed to teachers moderating their recorded responses. The Orientation teacher (Appendix D) admitted this had been the case, but having received support for his ideas, considered that he need not be so conservative in his estimations for future activities (Appendix H2).

Teachers of the new activities were laying their own opinions and preferences bare before the students and, for this study, before me as a colleague. This required courage as it opened both the activity and the teacher to criticism or even ridicule, as well as possible disappointment. By being tentative in their estimations of expected students' reactions the teachers lessened the impact of possible adverse reactions.

Isolated characteristics and interest redirection. Teachers were willing to isolate certain characteristics of the survey and to disregard others that they deemed of insufficient applicability to a particular situation. Teachers' interest in the environmental project of Appendix D focused on Communication and Enjoyment,

rather than the other three characteristics of the survey (Appendices H2 and H3). However, once initial concerns were alleviated, the teachers were able to consider other characteristics, as was the case with the biology teacher (Appendix H3). She was pleasantly surprised by her close estimation of the students' responses to the Communication characteristic, and her attention turned to exploring other characteristics. This rapidity of changing interest highlights the rate and flexibility at which teachers operate.

Catalyst for Change

Inferred alterations. The survey and graphical displays proved to be capable of being catalytic in generating changes in activities. Alterations were inferred from students' responses and comments, rather than students offering direct suggestions for changes. The open-ended item at the end of the survey provided students with the opportunity to contribute suggestions for improvements; however none were forthcoming. Open-ended responses tended to be reflective on what did happen, rather than what could have happened. Changes were initiated when teachers believed there to be significant differences between students' average responses to categories and their estimations of students' responses. The teachers developed changes as they sought plausible explanations for unexpected differences.

"No change" a useful outcome. It was not necessary for changes to be effected in activities for teachers to consider the use of SPAID beneficial. When teachers noted similarities between their expectations and students' responses they considered these to provide alternative confirmation that reinforced their personal perceptions. I found it reassuring when there were no students with strong negative reactions towards the Trigonometry activity in Appendix C (Appendix H1).

Small Changes

Changes that teachers effected following their consideration of SPAID results were small in nature. Characteristically they were neither startling nor dramatic, being idiosyncratic to the teachers' perceptions of the particular students and situation. Teachers' personal adaptations increased their levels of ownership in the activities. These attempts to improve the use of small individual events were grounded in the actions of teachers' routines (Goldenburg & Gallimore, 1991). Such refinements are considered to be a component of successful professional teacher development, crucial for teachers' adoption of change, and a means of increasing teacher satisfaction (Goldenburg & Gallimore, 1991).

Idiosyncratic reactions dependent on class and student. Teachers' adaptations of activities were influenced by their perceptions of each class. Different classes of different abilities received idiosyncratic treatment. My use of the SPAID package enabled me to view reactions of one class prior to the presentation of the activity to another class (Appendix C). Students' responses from the first class were influential in my adaptations of the activity for the second class; however, the two classes were considered to be of different academic abilities and the two presentations of the activity were also influenced by my perceptions of students' likely reception of tasks.

Idiosyncratic adaptations also applied at the individual student level. Not all students' queries during the activity were accorded equal assistance, as some students were provided with more definite guidelines than others, depending upon my judgement of each individual's capability to complete the tasks. Juggling degrees of assistance required continual decisions by teachers. Information from SPAID

provided them with indications that were combined with personal impressions that would otherwise dominate decisions.

Tangible evidence. Teachers may be exhorted by those occupying higher hierarchical positions to attempt new activities with their students but enthusiasm towards these efforts pale in the absence of tangible evidence that students have benefited. Fair questions that classroom teachers should ask following engaging any class in an activity include "Was it worth the extra effort?" and " Is it better than the traditional mode?" If they do not receive positive answers to these questions then they may wonder "Why do it?" The primary tangible measure of benefit within the Brunei education system is the percentage mark obtained in traditional tests and examinations. Students can understandably have difficulty accepting the content and intent of activities that deviate from their expectations, especially if they do not noticeably contribute to their final assessment (Wilson, 1994). Failure to produce noticeable improvements in the standard test results with classes in Brunei may increase obdurate beliefs in existing teaching practices for both those teachers undertaking the activities and observing colleagues.

Initial and small attempts at alternative activities in which teachers are encouraged to engage may too readily dissipate without fair trials unless there are means of tapping other domains, such as students' perceptions. The SPAID package provided teachers with an efficient means of tapping into these alternatives.

Cooperation

Use of the SPAID package promoted cooperation amongst teachers. My experience with obtaining translations of students' responses outlined in Appendix C demonstrated the ease with which assistance from colleagues can be achieved. The translating colleague was very willing to help and I believed that we both benefited

from the experience. Having a worksheet that had been used with two classes and had been supportively scrutinised by a teaching colleague provided me with greater confidence in offering it to other teachers on the staff. A recent survey in Brunei Darussalam on teacher concerns by Wong et al. (1999) noted that the sharing of resources with other teachers had the highest mean amongst items about the teaching profession. My previous experiences when offering worksheets to colleagues had ranged from enthusiastic acceptance through to the offer being declined before the teacher looked at the paper. The type of collegial exchanges promoted via obtaining translations of students' written responses and sharing tested worksheets must be a positive step in overcoming this concern.

Reduced isolation. The concern of teachers over the lack of sharing of resources (Wong et al., 1999) suggests a perception of isolation when teaching in Brunei. However, the cooperation evidenced through SPAID indicated that the isolation was not impermeable. Other teachers did note my Trigonometry activity even if they expressed no interest, as shown by the examination question included on my behalf (Appendix C).

Teachers can be overcritical of themselves, and the SPAID package provided students' views that supported and bolstered teachers in their endeavours. The biology teacher of Appendix D was pleased by the students' responses to the Enjoyment characteristic being more positive than her estimates (Appendix H3). Such support is always beneficial to a teacher but can be difficult to obtain under normal conditions.

Succinct Summary

Teachers appreciated the provision of a succinct summary that required a short period of time to consider. Those engaged in the activities of Appendix D

appreciated the inappropriateness of traditional methods to assess the success of the Project. However, they were also initially reticent about using the SPAID package to obtain indications of students' perceptions for fear that the time required for analysis may be beyond that which they were willing to spend. Although interested in their activities, their engagement in the Project had a lesser priority than their daily teaching so they had no enthusiasm to produce detailed analyses or reports of the activities. Hence, although the nature of the information produced from SPAID could be considered simplistic and limited in scope, teachers were willing to consider it as they were, with little time and effort, provided with conclusions that they deemed useful.

The display graph of primary interest to teachers was on Page 2 of the graphing template of SPAID (Appendix J). Teachers focused on the summary that compared students' average responses to the five characteristics with their own estimates of students' responses. The ability of the SPAID package to provide teachers of coeducational classes with pertinent gender-related data remained untested as the activities of this study were mostly undertaken in a boys' school.

Summary of Responses to the Fourth Research Question

A summary of observed responses to the fourth research question follows.

Question 4: What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?

Response: Teachers appreciated the provision of a structure for reviewing the use of activities with students. The presentation of information was considered timely and easy to understand, alleviating concerns over suitability of some activities. Teachers' beliefs remained influential to their reactions to students' responses, but the results from SPAID were catalytic to their considering

alterations to activities and provided indications of further development. Changes effected by teachers tended to be small in scale and idiosyncratic to the class or individual student involved. The need to obtain translations of students' responses promoted cooperation with other teachers.

These responses are addressed in greater detail in Chapter 5, where they promote discussion and provide indications for possible uses of the SPAID package by classroom teachers, as well as educational researchers.

Summary

This chapter described the steps in the development of the survey and graphing template that comprise the Students' Perceptions of an Activity Instrument and Display (SPAID) package. Included were issues considered important to improve the viability of SPAID for use by practising teachers. The second part of Chapter 4 contained observations of teachers while using SPAID with classes. Teachers considered the provision of a structure with which to gather indications of students' perceptions of activities in a timely manner was important, regardless of the time period between iterations of the activities. The information provided and the methods of display appeared to be appropriate for the teachers. Occasions when students' perceptions matched those of the teacher were considered important as they provided the teacher with confirmation and support for their endeavours. Changes that did occur were considered small in nature, being idiosyncratic to the particular situations. Enhanced cooperation with other teachers was found to be a useful outcome from the need for non local-language speakers to obtain translations of students' open-ended responses.

Chapter 5 moves on to consider the conclusions that teachers drew from these observations and possible implications for future uses of SPAID to assist teachers in

Brunei Darussalam government schools to experiment and develop new activities with classes as part of their normal operations.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

Teachers world-wide are subject to many calls for them to adopt changes in their approaches to teaching and learning, and those in government schools of Brunei Darussalam are no exception. Although situational constraints lead teachers to prefer routines that are conservative and involve little risk, some teachers do try new ideas with their students. A natural question for a teacher to ask following the trial of any activity is *How can I improve the activity?*

This study set out to answer this general question through seeking answers to four research questions. An outline of responses was given in Chapter 4 and is reiterated here.

Question 1: What are the perceptions of students that teachers of mathematics and science in Brunei Darussalam consider pertinent in their evaluation of new activities with classes?

Response: Teachers were interested in five characteristics: Understand Content, Communication, Relevance, Work Output, and Enjoyment.

Question 2: Is it possible to establish an instrument that will provide relevant student perception information?

Response: A search of a number of existing instruments (Appendix B) indicated the need to establish a new instrument (Appendix A). Two student versions were formed, the first in Bahasa Melayu and the second in English, while one teacher version in English paralleled the student versions.

Question 3: What form of presentation of student responses to the instrument do teachers consider readily serviceable?

Response: A computer template was constructed (attached floppy disk) to process responses to the survey and to provide graphs that display the numbers of responses. The survey and the computer template combine to form the Students' Perceptions of an Activity Instrument and Display (SPAID) package.

Chapter 5 progresses to focus on responses to the fourth and final question.

Question 4: What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?

The chapter begins with comments from observations during the construction of SPAID, and continues with inferences from teachers' reactions to their uses of SPAID. Next come conclusions drawn as a result of changes that were effected through use of the SPAID package. Limitations to the observations and conclusions precede suggestions for further directions and uses of SPAID. The final section of the chapter develops discussions relating to the difference between the scale of interest of established instruments, such as those listed in Appendix B, and the actions of classroom teachers on a daily basis. SPAID provides a means to span the difference, having the potential to support teachers and researchers in their monitoring of students' reactions to individual activities at a level smaller than those of the established instruments listed in Appendix B. These small-scale changes are the basic components that amalgamate to form the larger-scale shifts, and so are instrumental in converting eloquent calls for change into classroom realities.

Establishing SPAID

This first section of Chapter 5 provides conclusions from the process that culminated in the production of the SPAID package, and includes comments on the

five characteristics of SPAID and the criteria that were established to enhance the viability of SPAID for use by classroom teachers.

Characteristics

The five characteristics identified for use within SPAID were *Understand Content*, *Communication*, *Relevance*, *Work Output*, and *Enjoyment*. These characteristics stemmed from responses by the initial five teachers (Appendix G). Further support came from teachers involved throughout the study who were asked to consider the appropriateness of the five characteristics and whether there were other characteristics that ought to be included. Teachers appeared satisfied that the five characteristics provided appropriate coverage for the initial interests within the context of this study.

Criteria for this Study

The set of criteria established to enhance the viability of the SPAID package for classroom teachers was described in Chapter 3. Included in this set were the need for the provision of information to be timely and the need for data to be obtained with minimal intrusions into daily routines. Teachers in Brunei Darussalam government secondary schools are usually allocated multiple classes at the same level that undertake the same course of study concurrently. This suggested that teachers who do introduce varied activities into their practice were likely to repeat these same activities with more than one class over a short period of time. To be useful, information about students' perceptions needed to be available between successive engagements with these classes, enabling improvements to be made prior to iterating each activity with another class. Consequently, data needed to be gathered within the same teaching period as the activity occurred, and students' responses were to require no more than 10 minutes of class time for them to

complete. A time limitation for processing and considering results prior to the next iteration of the activity was set at 20 minutes. This was to cater for processing and considering responses at school in nonteaching time and repeating the activity with a different class later in the same day.

To accommodate the criteria established in this study the instrument had to be short and easy to use. With this in mind, a further criterion for the instrument was that it was to fit onto a single side of paper, including all instructions, the items, and the students' responses. This made it possible to provide students with both linguistic versions of the instrument, the Bahasa Melayu version being printed on one side and the English version on the other side of the same sheet of paper.

The set of criteria was successful as the teachers considered that the data gathering and processing caused limited intrusion into classroom routines, and the information obtained was deemed pertinent to their interests.

Use of SPAID

This section contains conclusions following students completing the survey and teachers processing the responses. Included are comments on the students' responses and the displays used to present data to teachers. Discussion then moves onto the two linguistic versions that were formed and students' responses to the open-ended item at the end of the survey. Conclusions from the change in perspective that was required by teachers to consider students' responses lead to remarks regarding the need for administrators and colleagues of the teachers to view the process as a strength in the context of government schools in Brunei Darussalam, rather than as a weakness.

Students' Responses

Willing and honest. Students were willing to contribute responses to the instrument in SPAID and teachers considered the students' responses were honest (Appendices H1 to H3), providing teachers with comfort in the credibility of the results. It is unusual for students in Brunei Darussalam to be asked to offer reactions to the learning activities in which they are engaged and the novelty aspect of the situation may have contributed to their enthusiasm.

Confidentiality. Anonymity of students' responses was invoked in this study to encourage the honesty of responses necessary if teachers were to deem students' responses credible. Hierarchical structures permeate society in Brunei Darussalam and there is a propensity for individuals to provide responses that they consider to be desired by those of higher hierarchical status. This influence was labelled acquiescence-to-authority bias earlier in the study and the use of anonymity aimed to limit its influence. The conclusion reached after considering the students' responses was that invoking confidentiality was successful, as the level of honesty evident in some students' comments was beyond that which teachers would have expected had the contributing individuals been identifiable.

Familiarity. Students gained familiarity with the survey when they engaged in a number of activities in quick succession and completed the survey following each occasion (Appendix D). Their predetermined responses to several items decreased the time required to complete the instrument and increased the efficiency of data collection. The rate at which these students completed some of the items indicated that they had been reflecting upon their participation and roles whilst engaged in the activities. Such introspection by students of their own actions and learning is seen as a positive product from regular use of the SPAID package.

Displays

Computer necessity. A conclusion following attempts to process responses by hand was the need to process responses by computer. The time and concentration level required when recording and processing students' responses precluded manual processing. Providing teachers with a rapid means of converting the students' responses into a summarised form was important if information were to be timely. The processing template developed for SPAID enabled teachers to process data within 15 minutes of sitting at a computer (Appendix F). The prevalence of computers installed with the Excel spreadsheet amongst government secondary schools in Brunei Darussalam suggested that it would be feasible to consider that computer processing is available for secondary school teachers throughout the country.

Readily comprehended displays. The displays of the information obtained via the SPAID package were readily comprehensible to teachers (Appendices H2 and H3). They considered the information portrayed by the line and bar graphs in the displays to be self-evident and clear. No teacher commented on inappropriate use of graphs, which made redundant my concerns described in Chapter 4 over the use of displays that could be considered technically inaccurate. Nor were there requests for displays of other combinations of data, leading to the conclusion that the display of data proved sufficient for the requirements of the teachers within this study.

Small n-*value influence.* The SPAID package was developed for use with individual classes and the influence that one or two students can have over the averaged responses for a class had to be borne in mind while considering the displays, especially when the number of students in the classes was small. The

smallest *n*-value in this study was for a geo-hydrology activity in which $n = 8$ (Appendix F2). For this activity each student represented 12½% of the responses, giving the opportunity for a single student to have significantly influenced the shape of the bar graphs. Individual responses that were outliers to those of the majority of students in classes were readily identifiable through the bar graphs in the displays. Including the frequency of responses at the top of each bar proved useful as this reminded teachers of the numbers of students the bars represented (Figure 6).

Linguistic Versions

Local-language version. The numbers of students who completed the instrument using the local language version (Appendix F) led to the conclusion that it had been necessary to form the instrument in a local language of the students. The translation between Bahasa Melayu and English used in this study appeared to have been acceptable to both students and teachers as students were able to complete the instrument without referring to the teachers for clarification of items or instructions.

Open-ended item responses. The number and willingness of students to respond to the open-ended item at the end of the instrument was considered a positive indicator of their interest in contributing to the teachers' knowledge. Comments that follow refer to the students' use of the Bahasa Melayu and English languages and the absence of students' suggestions for the improvement of activities.

All teachers who used the SPAID package in this study were expatriates with limited ability in the local languages of their students. Consequently, these teachers needed to arrange translations with colleagues when the students responded using local languages to the open-ended item. Translations of students' written responses could not always be obtained before teachers reused the activities and they needed to be prepared to continue without this information.

Students' efforts to provide open-ended responses in English were appreciated by the teachers. On some occasions students' limited familiarity with the English language led to their comments being difficult for the teacher to comprehend, such as the response "They do not frequently" by Student 17 from Table 8 in Appendix C. Teachers needed to accept that some comments were not able to be reconciled prior to iterating the activity with another group of students.

The open-ended item at the end of the instrument was designed to elicit students' suggestions for alterations to the activities that they believed might be beneficial to the activities. However, responses tended towards reactions to what happened during the activity rather than suggestions of possible alterations to the activities. Comments touching on behavioural alterations, such as slower pace, more repetition of explanations, and stricter discipline, were useful to the teachers but provided little direction to improving the activities per se. This was initially considered to reflect encultured attitudes towards education and society that might include framing teachers in the role of experts and the students as passive learners. However, on further reflection, teachers began to realise the difficulties that they experienced in altering their perspectives to those of the students were likely to be reflected and enlarged for students attempting the converse.

Required Change in Perspective

The biology teacher described in Appendix D believed a significant benefit from her use of the SPAID package in evaluating the activity she organised was the need to reconsider the activity from the perspective of the students. She held that this change in viewpoint should occur far more often in daily practice than it does. Although a very highly qualified, well trained, and very experienced teacher with pedagogical maturity, she found the reorientation required to consider responses

from the perspective of students difficult to achieve. An extension of this was that if teachers found the change in perspective so difficult, it may have been too ambitious within this study to expect students' reflection upon activities to lead them to offer possible alterations to the activities that may have enhanced the effect of those activities.

Having students realign their thinking may have run counter to traditional classroom attitudes. For students to manage changes in perspectives that lead to constructive suggestions is expected to require a gradual and prolonged implementation process, perhaps requiring years to develop in individuals. This viewpoint conforms with those of others who comment that change is a gradual process requiring time for results to occur (Wildy & Wallace, 1994), and when they do occur, the results can be expected to be unspectacular (Wallace & Louden, 1992). Considerable rapport and trust would need to be established with students before teachers may begin to obtain the style of information useful to aid them in restructuring activities. The practice in Brunei schools of teachers retaining classes for more than one year is certainly conducive to achieving this.

Strength, Not Weakness

Asking students for suggestions in areas where the teachers are expected to be the experts may have confused students from the traditional educational milieu of Brunei Darussalam government secondary schools. It may also have been difficult for colleagues, parents, and administrators, who are bound by preconceived expectations, to consider the process of asking students for suggestions to be a strength of the teacher rather than a weakness. The potential for observers to misunderstand the role students' responses play in the analyses of activities may have been a barrier to teachers' willingness to use the process required by the SPAID

package. Teachers who used the package needed to be assured of their own position as well as the potential benefits for students that were derivable from the use of the activities.

Teachers' Reactions to SPAID

This section considers teachers' reactions to the information they received through the SPAID process. It begins by noting the need for teachers to have inferred alterations to the activities from students' responses. Attention moves to the appropriately succinct nature of the information presented by the SPAID displays and its provision of a structure by which teachers could review students' reactions to new activities. Then follow comments about the ability of the instrument to gather information independently of teachers and the timely nature of the information provided by the SPAID process. Teachers relied in part on physical indications for clues of students' reactions to activities and the inaccuracy of these at times was reinforced. The use of the SPAID instrument was noted to promote collegial cooperation, and will be discussed further in this section. A comment about the use of the SPAID package with impromptu inspirations that occur during teaching concludes this section.

Inferred Alterations

Students' responses to the Likert-type items and the absence of direct suggestions for alterations to activities in their open-ended comments required teachers to interpret students' responses when considering possible alterations to activities. Teachers' beliefs have been considered to have a profound influence on their teaching and their facilitation of change (Borko et al., 1997; Cobb, 1988; Kempa, 1997; Koehler & Grouws, 1992) and such beliefs remained influential

during their interpretations of students' responses in this study. Many years of teaching experience had accumulated to form these beliefs and it can be difficult for teachers to be open and receptive to the legitimacy of alternative perspectives, especially within traditional educational settings. However, simply receiving and reading students' reactions established a change in these teachers' routines that was tolerable for them. Changes may have been slight and relatively low-key, but they were there.

Succinct Summary

The SPAID package supplied the teachers in this study with information that was sufficient and manageable. The succinct and summative nature of the information that teachers used when assessing the activities provided an example of their preference for brevity rather than detailed data. Most interest was shown in the summary graphs on pages 2 and 3 of the displays (Appendix J), with little attention given to the more detailed graphs of responses to individual items that occur on pages 4 and 5. Teachers generally are busy people facing a myriad of tasks that compete for available time and they need to make decisions quickly. This limits their inclination to investigate students' responses to activities in depth and the summary graphs proved apposite to their interest.

Class responses. Teachers were more interested in obtaining indications of groups of students' perceptions than investigating variant responses by individual students. SPAID displays provided a means to obtain general indications of groups' responses to activities, and the versatility of the graphing displays enabled the removal of responses by individuals that teachers considered were outliers to the remainder of the class. There was no suggestion that variant students' responses

could not be of interest to teachers, but rather with limited time available, teachers considered that their priority was to cater for the majority of students.

Structure to Review

A key benefit of the SPAID package noted by teachers was that it presented a process through which they could review activities. It provided a series of steps that enabled the teachers to begin considering alterations to improve the activities. Teaching in schools involves juggling a vast number of diverse tasks, each of which can appear to be the most urgent. Believing that it was merely beneficial to take time out from daily routines in order to review activities and to consider them from the perspectives of the students was not a sufficient reason for teachers in this study to do so. Further incentive or assistance was required. The structure of the SPAID package gave teachers the impetus to undertake a review that they otherwise would have found difficult to manage within normal daily routines.

Independent of Teacher

A pragmatic feature of SPAID was that students were able to complete the instrument in the SPAID package regardless of the teacher's presence, either while completing the items or even during the activity itself. This alleviated logistical difficulties on occasions, such as the teacher not being able to be present throughout the activity as noted in Appendix D. Teachers believed that the SPAID process could be applied to activities in which students' actions were independent of the teacher. This was seen as beneficial to the education of students as it supported teachers' attempts to have their students act independently from the teacher, thus encouraging them to become autonomous learners.

Timely Information

One conclusion from this study was the need for information to be timely if it was to be of use to teachers. The speed with which the computer template provided teachers with information was vital to its success, irrespective of the time delay between iterations of the activities themselves. Numerous tasks encroached upon the teachers' time and attention, and these could each have had the ability to appear more important than the other tasks that teachers needed to complete.

The existence of this pressure indicated it was even more important for teachers to record their conclusions promptly should there be a prolonged period between iterations, as occurred in Appendix D, than when the time period is a matter of hours or one day, as noted in Appendix C. When an activity was repeated within a short time period the immediacy of the events remained, assisting the teacher to remain focused on potential changes. In the event of a prolonged delay before iterating the activity with a new cohort of students, the immediacy and urgency to establish changes were removed. Teachers' recollections of events mellowed with time and the importance of actions became obfuscated if they were not considered with minimal delay and the reasons for alterations recorded.

Maturation period. Rapid provision of information enabled teachers to begin considering possible changes to the activities promptly. This provided as long a period of time as possible for alterations to mature within teachers' minds. For activities recorded in Appendix D there was to be a lapse of a year before possible iteration, and over that time there were likely to be many opportunities for teachers to reconsider the activities and contemplate changes. Alterations that teachers considered making were expected to be remoulded over this period through unpredictable moments of inspiration. Consequently, final outcomes from reviewing

the activities would not be apparent until the series of activities was repeated with the next cohort of students.

Alleviation of concerns. The alleviation of teachers' initial concerns about whether students considered the activities to be legitimate educational activities proved to be one of the more immediate benefits when engaging the SPAID process. Any form of experimentation with the education of students is a serious affair and attempts at new activities present many uncertainties for teachers. There is a considerable list of descriptors that have been associated with the trial of new educational activities with students; uncertain, intangible, complex, erratic, unpredictable, risky, threatening and confusing for teachers, requiring conflict, and prone to disagreement (Fullan, 1991; Fullan & Hargreaves, 1992; Fullan & Miles, 1992; Futrell, 1988; Hiebert et al., 1991; Wallace, 1997). Teachers in Brunei Darussalam can add potentially serious financial ramifications to this list should they breach unwritten and sometimes indistinct boundaries of tolerable behaviour. These descriptors combine to put considerable pressure on teachers when they try new ideas.

Obtaining rapid confirmation that students' perceptions of new activities were not significantly different from their own expectations enabled the teachers in this study to continue those activities with greater confidence, commitment, and enthusiasm (Appendices H1 to H3). Having evidence to support teachers' beliefs was beneficial to encouraging them in their trials of new teaching and learning ideas with students.

Concerns over the acceptability of activities by students were noted to dominate teachers' interests in their students' perceptions of the activities at times. These concerns were rapidly placated via SPAID outcomes, with teachers then able

to turn their attention to other characteristics of students' reactions to the activities. Teachers had seldom considered beyond their initial concerns and had not predicted directions of further interest. The biology teacher who is mentioned in Appendix D had initial interests in the characteristics of Communication and Enjoyment (Appendix H3). Having received information on these, she was then able to move on to considering other interests in the remaining characteristics, of which the characteristic Relevance proved to appeal.

The uncertainty and the rapidity with which teachers' interests changed were indicative of the constant state of flux that engagements with students present to teachers. SPAID proved to be sufficiently specific to provide information in areas of initial interest as well as sufficiently general to provide information in other areas that became of interest once the initial interests were informed.

Physical Indications

My continued overestimation of students' enjoyment in the trigonometry activity of Appendix C suggested that I had more to understand regarding their displays of enjoyment. This reiterated the differences that can exist between teachers' and students' perceptions of the same event (Wildy & Wallace, 1994; Wubbels, 1993). Some of the physical actions that I used as indicators of students' reactions to activities may have been culturally biased and difficult for me as well as other expatriate teachers to recognise. SPAID provided a means by which these perceptions could be more explicitly stated or indicated, circumventing some of the linguistic, cultural, racial, and other barriers to communication that exist between students and the many expatriate teachers in Brunei Darussalam government schools.

Collegial Cooperation

Collegial cooperation was positively influenced through the use of the SPAID package. The requirement for translations of students' responses to the open-ended item in the instrument from local languages into English proved equivocal for teachers without the necessary linguistic ability. However, the need for a translation service did open opportunities for collegial cooperation between teachers. This was simple to achieve, but the teachers making the requests needed to have sufficient confidence and trust in their colleagues to allow this to take place.

Requests for assistance from colleagues reduced the traditional isolation in which teachers have been noted to operate (Fullan & Hargreaves, 1992). Although this was a small step, it was a positive one towards creating the type of culture of collegial collaboration called for to counter the widespread individualism and isolation of schools (Hargreaves, 1992). One advantage of this cooperation, that is reflected in literature, was that teachers in this study had to clarify the intentions of the activity before approaching colleagues for translations of students' comments. This fostered and encouraged the teachers to be focused and motivated by the activities (Wildy & Wallace, 1994).

The interest of Brunei Darussalam secondary school teachers in participating in research on teaching has been noted in a survey as having the second lowest level of concern amongst items on concerns of the teaching profession (Wong et al., 1999). However, in the same survey, the desire for sharing of resources with other teachers obtained the highest mean amongst items on the teaching profession. The collegial exchanges experienced through using the SPAID package were an encouraging move towards meeting this apparent mismatch.

Central to this study was that the origin of the sharing of ideas came from *amongst* teachers, rather than being imposed or provided from those higher on hierarchical ladders. The development of the SPAID package empowered teachers by their adopting the central and controlling role of the study (Kyle et al., 1991), rather than taking their traditional marginal roles in determining the directions of changes (Atkin, 1989). The ideas were initiated, developed, and assessed by and for classroom teachers. Teachers who use the SPAID package are able to complete the process without the need of other assistance. Consequently, teachers remain in control of what happens, sharing with others as much or as little of the outcome as they desire.

Concurring on uncertain responses. Teachers received some students' open-ended item responses in written English which they had difficulty comprehending. This was accepted as a restriction to communication which occurs when teachers' limited fluency in a language in common with students nullifies their mutual use of a familiar language. On occasions teachers had difficulty comprehending the intent of some students' written comments. They were reassured when a teaching colleague corroborated by also expressing his or her own difficulty in comprehending the student's intent.

Impromptu Inspiration

Good teaching ideas can occur at any time and inspirations cannot always be predetermined. Teachers' interests in the effectiveness of impromptu activities may equal that of prepared activities. Indeed, they may exceed usual levels of interest due to the high personal ownership that inspiration carries. I found this to be the case within my own teaching, with two examples providing data for Activities 6 and 7 listed in Appendix F, and outlined in Appendices F6 and F7. Having a quantity of

instrument forms ready and available while teaching proved useful in catering for these unpredictable moments of inspiration.

Changes Effected

In the absence of other tangible evidence, teachers are reliant upon their subjective estimates when judging students' reactions to activities. These may be inaccurate, as teachers and students can often have conflicting perceptions of the same event (Wildy & Wallace, 1994; Wubbels, 1993). The SPAID package has provided teachers with a viable means by which to obtain indications of their students' perceptions towards activities. The identification of differences between students' and teachers' perceptions provided indications for alterations that teachers considered improved the value of activities. This section presents features of changes that occurred consequential to teachers using the SPAID package. First, however, will be a section describing the benefit of students' responses that led teachers to make informed decisions not to alter the activities.

The "No Change" Decision

Teachers found it highly worthwhile to be apprised of instances when their own estimations of students' perceptions aligned with those of the students. Differences between many of the teachers and students in government schools of Brunei Darussalam include language, culture, race, and religion. These differences impede verbal and nonverbal communication between students and teachers and the students' responses via SPAID provided teachers with valuable insights that were otherwise obfuscated by the differences.

Traditional approaches to education in Brunei schools leave students with expectations regarding what happens in classrooms. One of the more immediate of

teachers' concerns with using new activities was whether students accepted the activities as legitimate within the various courses of study. Information available through the SPAID package quickly alleviated this concern. Simply being made aware that no student had strong negative reactions towards an activity provided tacit and tangible support for the teachers' decisions to engage the classes in the activities. This was deemed valuable in itself and proved to be a prompt and helpful contribution through providing realistic support to classroom teachers in the important affective and moral domains (Crandall et al., 1986). Teachers were then able to move on from the fundamental decision of whether the activity should be included at all, secure in the knowledge that at least students did not reject it.

Decisions to retain all or parts of activities were informed by more than solely the teachers' subjective assessments. This allowed teachers to pursue promising directions of development and to refine their practices, an approach that Wallace (1997) considers to be a positive direction in bringing about change. All teachers in this study continued using and adapting new activities with increased levels of confidence, commitment, and enthusiasm. Such timely ratification is often lacking in normal educational practices, and all teachers considered this aspect of the SPAID package to be a significant contribution to their assessment of activities.

There were no examples from the activities listed in Appendix F of a teacher abandoning an activity due to students' responses. Teachers in government schools of Brunei Darussalam appear to be firmly convinced of the worthiness of an activity before, of their own volition, introducing it into a class situation. Consequently, teachers could be expected to have considerable bias towards the activities, which would influence their interpretations. However, the teachers who used the SPAID process did so due to their concern over the reception of the various activities by the

students and for them to have ignored indications of inappropriateness would have been counterproductive. The level of significance of students' responses depended upon the teacher and the situation, being part of the nebulous nature of human behaviour.

Small-Scale Changes

Changes that teachers effected following their consideration of results from the SPAID package were small and specific in nature. Alterations tended to be idiosyncratic and highly applicable to the specifics in which the teachers were engaged at the time. The small and incremental changes observed in this study were considered to be most suitable in the light of suggestions by Fullan and Hargreaves (1992) who offered that there are three general requirements for teachers to begin to practise risk-taking as part of change; being selective, small scale, and taking positive steps by trying something rather than refusing to try something. All three criteria were well represented by the efforts of teachers in this study.

Many indications from literature suggest that a means of effecting successful changes is through small changes that are pertinent to the daily lives of the teachers, and that emanate from within the teachers themselves rather than being imposed upon them (Atkin, 1989; Borko et al., 1997; Fullan, 1991, Fullan & Hargreaves, 1992; Futrell, 1988; Gervasoni, 1994; Goldenburg & Gallimore, 1991; Jones, 1995; Koehler & Grouws, 1992; Kyle, 1991; O'Loughlin, 1992; Richardson, 1992; Shymansky & Kyle, 1992a; Theissen, 1992; Wallace, 1997; Wallace & Louden, 1992; Wildy & Wallace, 1994). The changes to activities made in this study originated from classroom teachers in response to situations that they believed they could improve. This placed teachers central to, and in total control of, the events that occurred in this study, auguring well for successful implementation of those changes

and the ability of the SPAID package to assist in improving the impact of the activities. In the terms of Fullan (1991), the motivation for teachers' actions came from the desire to solve real problems, rather than from symbolic opportunism for personal gain.

Interest Central

Central to the ability of the SPAID process to provide teachers with indications for alterations to improve their use of new activities was the interest of each of the teachers. They approached the process with minds tolerant of alternative perceptions and willing to attempt changes. The classroom teachers who initiated the activities with classes perceived those activities to be sufficiently relevant to the courses of study to warrant inclusion. Although there were occasions when the available equipment may have been less than they desired, teachers did consider there to be sufficient resources for the activities to proceed. This endorsed Fullan's (1991) suggested three change components; relevance, readiness, and resources. Teachers considered the activities to be relevant, they had sufficient readiness to engage the students in the activities, and they had sufficient resources to undertake the activities.

The SPAID package provided a process that teachers voluntarily applied to obtain indications of students' perceptions of activities. The outcomes did not suggest the process to be a panacea for improvements. Rather, it required the teachers to consider the students' responses and then to use their existing skills and knowledge in configuring possible alterations to align with the idiosyncratic contexts. Such utilisation of teachers' compiled professional knowledge, amassed and sorted though years of experience and hard work, is considered beneficial to attempts at changes in teaching and learning (Wallace & Louden, 1992; Wildy &

Wallace, 1994). Information available through the use of SPAID in turn added to teachers' professional knowledge, which will improve their initial attempts with further new activities, forming a spiral of improvement from which both students and teachers may benefit.

Summary of Responses to the Fourth and Final Research Question

This section provides a summary of four responses to the fourth and final research question.

Question 4: What influence does information obtained through the instrument have upon mathematics and science teachers' adaptation of activities?

Response 1: The most immediate result from teachers considering the outcomes produced through the SPAID package was their increased confidence in the worth of the activities. The prompt and practical provision of information enabled teachers to allay their concerns over whether the activity should have been attempted, a development that can be uncertain for foreign teachers in the culture of Brunei government schools.

Deciding whether the activity was accepted by students, or simply not rejected by them, was an early step to answering the ubiquitous question *Was it worth it?* Answers to this may always be clouded in uncertainty, depending on the criteria used. Teachers' reactions to the information from SPAID enabled them to look for means to improve the effectiveness of the activity cognisant of the students' reactions, in order to promote the desired changes and learning outcomes.

Teacher as learner.

Response 2: SPAID provided a structure for teachers to begin reviewing the use of an activity with students.

As teachers considered the outcomes from the SPAID package they adopted the role of learners. The framework of Fullan et al. (1990) that linked classroom and school improvement was illustrated by Figure 2 in Chapter 2 of this study and contains three larger wheels each containing four smaller wheels. A number of the smaller wheels were indicated to be potential beneficiaries of this study. The interaction between the wheels was considered important by Fullan et al., evidenced through movement, albeit not mechanistic. This was observed in this study. Although the smaller wheel labelled Collaboration was not indicated in Chapter 2 to be directly assisted by this study, the necessity for expatriate teachers to obtain assistance from local-language-speaking colleagues created movement in the Collaboration wheel. Such interchange between teachers may in turn influence the Collegiality wheel contained within the larger School Improvement wheel. The movements may have been slight, but their existence provided much promise for the future improvement of classrooms and schools alike.

Enhanced cooperation, reduced isolation.

Response 3: The use of the SPAID package enhanced cooperation.

The cooperation necessary to obtain translations of students' responses to the open-ended item in the SPAID instrument reduced the impact of isolation that is typical between teachers (Fullan & Hargreaves, 1992). While some teachers may consider the isolation preferable (Hargreaves, 1992), for those interested in opening their actions to others the process of using the SPAID package provides a means for them to introduce new ideas to colleagues. Teachers can operate at levels with which

they are comfortable, and are able to collaborate as much or as little as they wish. Not only are they tinkering with the teaching and learning ideas they employ with students (Wildy & Wallace, 1994), they are also tinkering with the teaching and learning ideas they are sharing with other teachers.

Teachers as researchers.

Response 4: The development and use of the SPAID package placed teachers central in educational research.

The gap between researchers and classroom teachers is coming under increasing scrutiny (Malone, 2000). Differences in the agendas of these two parties (Roth, 1998) may contribute to their inability or unwillingness to communicate, but when teachers used the SPAID package they were the researchers. They were not only the initiators of the changes, they were the ones to effect those changes with students, to turn their beliefs into reality. The teachers had moved to the middle ground. While being there did not automatically produce solutions, it did put the teachers in control of attempting change.

Limitations

This section outlines limitations evident during the study and is divided into two parts. The first part describes limitations that occurred during establishing the instrument and computer template that comprise the SPAID package, and includes the identification of the five characteristics of the survey as well as comments on the absence of statistical analysis that is usually present during the formation of such instruments. The second part focuses on limitations noted during teachers' uses of students' responses and includes the confidentiality of responses, the language

students used in responding to the open-ended item in the survey, and the intra-teacher nature of findings.

Establishing SPAID

Identification of Characteristics

Five experienced teachers contributed the initial suggestions that led to the formation of the five characteristics identified in the SPAID instrument. The small number of teachers may be regarded as a limitation in the establishment of the characteristics. However, a small measure of tacit support did come from the other teachers involved in the study. All teachers who participated in the various stages of the study were asked for their comments regarding the suitability of the characteristics and for possible alternatives for inclusion. No dissatisfaction with the five characteristics was expressed by any of the teachers and no suggestions for further ideas were forthcoming. This alluded that there were no obvious omissions of sufficient magnitude to the teachers for them to mention.

Statistical Analysis

A standard approach to establishing educational psychosocial instruments is to conduct statistical analyses of responses in order to group items into scales or domains that are relatively statistically independent of each other. No such statistical analysis of the items and five characteristics was carried out on the responses to the instrument in the SPAID package. This could be considered a limitation with which researchers, who are not charged with daily responsibility of teaching school students, may find difficulty.

Reasons for not adopting the statistical analysis path were two-fold. The first involved the nature of the activities and the groups of students. The SPAID instrument was designed for use with differing groups of students whose responses to

the instrument would be with respect to differing types of activities in different contexts. Teachers' interests related to particular activities, leading to relatively isolated interests with potentially little connectivity rather than more global pictures that might be considered sufficiently large to warrant statistical analyses.

The numbers of students who responded to the survey in the SPAID package following their engaging in activities was as low as 8 and averaged 19.2 (Appendix F). The idiosyncratic nature of the contexts suggested combining or extrapolating results from one context into another to be inappropriate. It was difficult to justify combining the reactions from 8 students on a Form 6 geography field trip into the jungle (Appendix F, Activity 2) with those from 24 lower ability Form 4 students engaged in a classroom based paper activity (Appendix F, Activity 12). The natures of the activities were very different, as were the natures of the cohorts of students. On one occasion the students' responses were amalgamated and this instance is recorded in Appendix D. This situation was quite atypical of the primary intention of the SPAID package as the teacher was seeking a general impression of students' reactions to a series of activities. Loss of information specific to particular activities was quite acceptable to the teacher on this occasion.

The second reason item analysis was avoided in this study was more compelling and came from the teachers involved in this study. They wanted indications of students' reactions to the five characteristics and the items within each, and several had distrust in the possible dictation to their wants by statistics. This may be a legacy of the gap between the needs of classroom teachers and researchers (Atkin, 1989; Fullan, 1991; Kempa, 1997). Teachers were central to the research in this study, being active participants through identifying key questions, establishing the research agenda, and interpreting the findings (Kyle et al., 1991). Research

requirements were to be cognisant of, and subservient to, the wishes of classroom teachers. They were wary and distrustful of the use of statistical analysis to decree the composition of characteristics. The teachers were acutely aware that the five characteristics may be somewhat nebulous in nature, expecting that there may be high correlations between characteristics, and that item analysis might indicate that items in the same characteristic may be relatively statistically incompatible. Regardless, teachers desired general indications of students' responses to the listed items. They were interested in the mean score of the three items within each of the five characteristics, with the negative items being scored in reverse. However, the responses to individual items were retained in the displays in case they proved of interest. Consequently, I did not undertake the usual statistical analysis so as to avoid alienating the participating teachers.

Teachers' Uses of Responses to SPAID

Confidentiality

The anonymity of students' responses to the SPAID instrument was believed important in this study if teachers were to consider the students' responses credible. A limitation with this approach was that it obstructed further investigation into individual students' responses. This was notable when the intentions of students' written responses to the open-ended item at the end of the survey were too indistinct for the teacher to comprehend, such as Student 17 from Table 8 in Appendix C who responded with "They do not frequently". Confidentiality obviated opportunities for the teacher to seek further meaning of this comment from the student.

Language of Open-Ended Item Responses

Two linguistic versions of the instrument within the SPAID package were presented to students in this study. Students who responded to the open-ended item at

the end of the instrument used the language of the version they chose. Those who used the Bahasa Melayu version responded to the open-ended item in Bahasa Melayu, and those who used the English version responded in English. Foreign teachers who were not able to understand students' responses written in local languages found this lack of knowledge to be a limitation, especially as the anonymity criteria prevented investigating students' intentions further.

This was a study to support classroom teachers in their normal praxes and the rapidity with which teachers require information was reflected in the criteria established for gathering and processing data in this study. Ten minutes were allocated for obtaining students' responses and twenty minutes for teachers to process, consider, and draw conclusions from these responses. Opportunities in normal praxes for teachers to discuss responses with the relevant individual students from one class are unlikely to arise prior to repeating the activity with the next class. This reflection of reality, together with the expected loss of validity and increased uncertainty over the authenticity of responses if individuals were identifiable, led to the conclusion that retaining the students' anonymity was preferable to seeking a means to link individuals to their responses under the current conditions.

Small-Scale Intra-Teacher Changes

The idiosyncratic nature of teachers' alterations to activities suggested limited transferability of findings beyond the immediate concern of the teachers. Goldenburg and Gallimore (1991) have described this as the "mundane but very real detail of teachers' daily work lives" (p. 69). It is well to recall that the SPAID package was designed to help teachers to improve their employment of new activities with their own students. The primary focus for transferability therefore was intra-teacher, the adoption of changes and non-changes to activities that teachers attempted with their

own students based upon evidence supplied by the SPAID process. This knowledge added to the teachers' existing mosaics of perceptions and expectations that influence their beliefs in classroom teaching and are so influential in their reactions to further changes (Cobb, 1988; Koehler & Grouws, 1992). Successful small-scale changes to teachers' individual efforts with activities in this study were considered to have a small but positive influence on their receptivity to considering using more new ideas with students.

Further Directions

This section considers further directions of investigations that emanate from this study and is divided into two parts. The first part discusses possible reconsideration of the development that occurred to establish the SPAID package and the second part looks to further adaptations of the instrument and displays of responses.

Establishing SPAID

SPAID was developed to provide teachers with indications of students' perceptions towards new activities. These could then be included when considering modifications to improve the efficacy of the activities and to improve the teaching and learning within classrooms of Brunei Darussalam government schools. There are now opportunities to refine the SPAID package by reconsidering the steps taken in its formation. Potential directions for improvement include reconsidering the characteristics considered in the SPAID instrument, and looking for further trials that test the criteria established to enhance the viability of SPAID to operate within the daily routines of busy classroom teachers. A comment on the confidentiality of

students' responses concludes this first section of further directions for the SPAID package.

Identification of Characteristics

The five teachers who initially contributed ideas from which the five characteristics of SPAID were established (Appendices G1 to G6) comprised a small sample. Care was taken to include combinations of males and females, locals and expatriates, and teachers of mathematics and science who were all experienced and respected classroom practitioners (Table 3, Teachers A to E). A direction for further development of SPAID would be to revisit the identification of the characteristics.

There is scope to widen the range and number of teachers contributing ideas for investigation. One group may be neophyte teachers who have newly graduated from the Universiti Brunei Darussalam. Providing these young teachers with a means to address their areas of interest in the early and formative years of teaching may enhance their becoming familiar and confident with trying new teaching ideas. This would foster their constant reappraisal of the teaching and learning activities in which they engage students. Improvements to the activities will then occur through informed experimentation, considered a powerful way to develop crucial ownership in teachers (Goldenburg & Gallimore, 1991; Huberman, 1992; Wallace et al., 1995; Wildy & Wallace, 1994), as well as being helpful in developing teacher satisfaction throughout their careers (Huberman, 1992).

Engendering a milieu in which newly qualified teachers are using a wider range of means to guide the development of the activities in which they engage classes of students may narrow the gap between teachers and educational researchers. Teachers would be conducting their own research for their own benefit, identifying key questions that are of interest to them, establishing their own research

agendas, and interpreting the findings themselves within their own contexts. This brings teachers to the centre of research, which is in direct contrast to the marginal role to which teachers are traditionally assigned (Atkin, 1989, Kyle et al., 1991).

Statistical analysis. Absence of statistical analysis of the items and five characteristics of this study is recognised as a limitation of the study from a pure research perspective. Opportunities exist for researchers to delve further into responses to the instrument in the SPAID package using statistical techniques. Teachers involved in this study indicated distrust in statistical analysis of items that might direct which items belong with which other items and in which characteristic. The avoidance of using item analysis added a form of face validity for the teachers involved in this study, and a line of further investigation would be to focus on teachers' reactions to such statistical analysis, shedding important light on the gap that these reactions indicated exists between the world of educational research and that of real and everyday classroom teaching. Suggestions as well as actions for bridging the gap between these two groups need to be explored if teachers are to believe the numerous calls to involve them as serious contributors to research (Atkin, 1989; Borko et al., 1997; Fullan, 1991; Fullan & Hargreaves, 1992; Futrell, 1988; Gervasoni, 1994; Goldenburg & Gallimore, 1991; Hallinan, 1996; Kempa, 1997; Kyle, 1991; Kyle et al., 1991; Theissen, 1992). This will be crucial if a symbiotic relationship is to develop between the communities of classroom teachers and educational researchers.

Criteria for this Study

Chapter 3 contained an outline of the criteria designed to enhance the practicality and viability of the SPAID package for use by classroom teachers within their existing practices. The processing of data and considering of alterations within

20 minutes was achieved in the instances observed in this study. However, teachers tended to time the first engagement of a new activity with a class so that more than a single teaching period occurred before iterating the activity with another group of students. Consequently, the ability of SPAID to provide useful information within a pressurised time restriction was not fully tested. There remain opportunities for testing of SPAID under conditions of greater exigency.

Confidentiality. My experiences at obtaining responses from students in a Brunei Darussalam government school (Nannestad, 1997) and discussions with the teachers during this study indicated that anonymity of students' responses to the instrument within SPAID was important if teachers were to consider students' responses to be credible. However, this did obviate opportunities for further investigation of individuals' responses and may be seen as a limitation to the study. Should a means of identifying individual respondents be developed that retained teachers' belief in the credibility of students' responses, then many further opportunities for educational researchers will unfold. Students whose responses are typical, unique, or have some other combination of attributes from within a group of students may be identified as subjects for case studies (Merriam, 1998). The graphical displays in SPAID provided a ready means by which to identify the existence of such students.

Adaptations of SPAID

The SPAID package has provided teachers with information of students' perceptions towards activities undertaken as class activities. This information was then used to enhance the teaching and learning that occurred in similar class situations. This section considers the information that teachers obtained and looks at further adaptations of the SPAID package that might prove useful to classroom

teachers in Brunei Darussalam government schools. These include the potential for the longitudinal use of the SPAID package to support teachers to provide classroom environments conducive to students' learning and reconsidering the graphs presented in the displays of information. The linguistic constructions of both the Bahasa Melayu and English versions of the survey are open to more detailed scrutiny, and the scope of the open-ended item at the end of the survey may be expanded. There are opportunities for SPAID to assist teachers' comparisons of different approaches to presenting content to students and to gain insights into the physical indications of students.

Longitudinal Use

The SPAID package proved capable of assisting teachers in their development of activities for use with classes of students. Subject teachers in Brunei government schools typically follow the same classes for more than one year. Teachers of junior secondary school students cover the three years in the junior secondary school (Forms 1–3), teachers of upper secondary school students have classes for two years (Forms 4 and 5), and teachers of Form 6 have the same groups of students for the two years of Lower and Upper Form 6. This constancy opens opportunities for teachers to use the SPAID package to promote longitudinal development as it is possible for a teacher to track responses from one class whilst they are exposed to several different activities over a number of years. Informed profiles of classes may be established, with preferences for activities able to influence teachers' preparations and adaptations of activities prior to use with each class.

The matching of activities with students' preferences aligns with findings that students achieve better where there is a greater congruence between the actual

classroom environment and that preferred by students (Fisher & Fraser, 1983a; Fraser & Fisher, 1983c,d; Fraser & Rentoul, 1980). As teachers gain knowledge of the activities preferred by students, they may use this knowledge in their presentation of activities to improve the fit between the activities and the students.

Displays Used by Teachers

Graphs within the SPAID package (Appendix J) include presentations of responses by gender. The second line-graph on Page 2 of the display compares male and female response totals for each of the five characteristics and the bar graphs on page 5 show the frequencies of male and female responses for each of the fifteen items in the survey. The activities in this study predominantly occurred in one of the few schools in Brunei that cater solely for boys and opportunities exist for teachers in coeducational schools to test the usefulness of the gender-related data presented by SPAID displays. The identification of gender differences in learning environments in Brunei Darussalam (Riah & Fraser, 1999) suggests this to be a direction of research pertinent to government schools in Brunei Darussalam.

The SPAID package provided classroom teachers with rapid and general indications of students' reactions to specific new activities. Combining responses from several classes did occur on one occasion in this study (Appendix D) with the purpose of gaining broader impressions at a level of generality even greater than the original intent of SPAID. The ability to produce a combined summary of responses demonstrated the template used to process students' responses to have a pleasing level of versatility. However, combining data from different classes is not expected to be of strong interest to classroom teachers when considering potential changes to specific activities with classes of students. Whether the displays could provide teachers with useful information when combining the responses from many classes in

other situations may be worthy of further investigation.

The template used to process the responses from the SPAID instrument provided a number of graphs to display data (Appendix J). Teachers showed little interest in the graphs of individual items produced on pages 4 and 5 of the displays during this study, considering that the information contained in these graphs was outside their immediate interests when adapting the activities. However, they did consider the information could be of interest in other situations and this possibility opens opportunities for further investigations. As teachers become more practised in their management of new activities with students, they may find incentives to turn their interests towards the responses of individuals that diverge from the remainder of the class. The SPAID displays provided a ready means to identify individuals' responses that differed from the remainder of the sample. This is approaching the arena of case studies and may be more appropriate for researchers or teachers involved in specific studies rather than the daily involvement in teaching that this study supported.

Linguistic Constructions of Language Version

Lack of fluency between the Bahasa Melayu and English languages resulted in my reliance on teaching colleagues to provide translations between Bahasa Melayu and English and considerable effort went into obtaining accurate translations. However, there are opportunities for researchers to reconsider the language used in both the Bahasa Melayu version and the English version, perhaps in combination with a review of teachers' suggestions for the characteristics to be considered. A ready familiarity with both languages would appear to be a prerequisite to improving the accuracy of the translations. Further development of the SPAID instrument in this

regard may be an apposite direction of interest for a local teacher from Brunei Darussalam conducting research as part of advanced professional development.

During the construction of the SPAID instrument there was a conscious effort to use English words and sentence structures that were clear and direct. In this I was guided by advice from colleagues knowledgeable and experienced in the teaching of English to students in government schools of Brunei Darussalam. Further scrutiny of the linguistic construction of the English version of the instrument may prove beneficial to enhancing students' comprehension of the instructions and items.

Most secondary schools in Brunei Darussalam cater for students from Form 1 to Form 5 whilst the majority of students commented upon in this study came from Form 4 and Form 6 (Appendix F). Pressures from external examinations at the higher levels of secondary schooling suggest that teachers may be more inclined to engage students in learning activities that vary from established norms at the lower and younger levels of secondary schools. Use of the SPAID package with more students at the Forms 1 and 2 levels would further test the translations with younger students who may have greater reliance upon the local language version of the instrument.

Open-Ended Responses

The open-ended item at the end of the instrument was included to provide students with the opportunity to offer reactions that were not catered for in the fifteen Likert-type items and to tender suggestions to improve the use of the activities. That the students gave reactions to the activities rather than suggestions for improvements points towards the possibility of including two open-ended items. The first could ask students for their reactions to the activity, and the second could give them opportunity to offer suggestions for improving the activity.

Comparison of Activities

In-service and teacher training courses that teachers attend over the years can present them with a vast array of alternative teaching and learning ideas for use with classes. Teachers' repertoires can accumulate more than one activity to develop the same content with students and the decision when to use which activity arises. The SPAID package provides teachers with a common means of comparing different activities as a balance to their innate impressions, enabling them to make more informed decisions and justify their choice of one activity, over others, with a group of students.

Effective Teaching

SPAID offers teachers a means to clarify the intent of the activities for students, to develop knowledge of the students, and to monitor students' understanding through regular and appropriate feedback. These are among the features of effective teachers identified by Porter and Brophy (1988). Whether a teacher could achieve the label of "effective" through adopting these features when they otherwise would be excluded remains an intriguing direction for further investigation.

Physical Indications

The disparity between students' physical actions whilst engaged in activities and my interpretations of them indicates a dimension that is worth further investigation. There is a need to retain the traditional values of cultures when considering educational changes (Hurn, 1983) and the SPAID package may provide a means of identifying pervasive differences between the cultures of students and those of teachers imported to teach in Brunei Darussalam government schools. Further investigation into these differences would assist the expatriate teachers to

adapt their understanding of the students' physical actions, and thereby improve the communication necessary for quality teaching and learning to occur.

Microlevel Instruments

This final section of Chapter 5 considers the scale of instruments used to obtain student perception information. Existing large-scale instruments are compared with small-scale instruments such as SPAID, and discussion moves to the integral role that SPAID and other small-scale instruments may play in the improving of classroom climates.

Macrolevel and Microlevel Instruments

Educational environment instruments, such as those in Appendix B, have been espoused for over a quarter of a century and continue to prove highly beneficial to research (Fraser, 1994, 1998a,b). They provide opportunities for interested teachers to stand back and look at valuable *macrolevel* profiles of the educational environments in which they are immersed. The scale of interest is larger than their day-to-day concerns, and for this to be useful within their daily reality teachers then need to interpret the macrolevel information within their own perceptions of their immediate milieu. In contrast, the most immediate pressure on classroom teachers is at the *microlevel*, the day-to-day delivery of curriculum that may be repetitive, but comprise the detail required of teachers (Goldenburg and Gallimore, 1991). Whilst teachers appreciate the macrolevel picture, the necessary involvement and commitment to obtain macrolevel information is extra to the more immediate daily demands on their time and workloads.

The generalised nature of macrolevel data provides long-term goals in which teachers may have an interest but they are likely to experience less involvement,

satisfaction, or ownership than small-scale immediate changes at the microlevel that they can personally observe and effect in the short-term. If macrolevel instruments provide information about classroom *climates*, then the SPAID package, as a microlevel instrument and to continue the meteorological theme, provides information about classroom *weather*.

The climate/weather analogy illustrates the influences on daily actions. The decision whether to carry an umbrella on a walk may be more influenced by looking out of a window to see if it is raining or if rain clouds are imminent than reading the regional average rainfall records for the last few years. The umbrella-carrying decision is also influenced by local knowledge and experiences, which may suggest it prudent to carry an umbrella even if the sky is clear of clouds. In tropical Brunei Darussalam umbrellas are useful for protection against both rain and sun. Should an umbrella be carried, the weather at the time determines if it is opened or remains closed. Actions of the moment are dictated by the weather of the moment, not the climate established from averaging the outcomes from a number of years.

Teachers can influence the weather of the classroom. The three general suggestions by Fullan and Hargreaves (1992) for beginning to practise the risk taking that is a component of bringing about educational changes are; (I) be selective, (ii) be small scale, and (iii) take positive steps by trying something rather than refusing to try something. The SPAID package provides a means by which teachers can obtain data on specific activities. Alterations to improve the effect of the activities can then be made from more informed positions than would otherwise be possible. These gradual improvements in classroom activities can create a gradual altering of the weather of the classroom, which in turn has the potential to accumulate over time and influence the climate of the classroom.

The Role of Microlevel Instruments

The SPAID package has been developed in response to the specific interests of teachers who wished to improve the potency of new teaching and learning activities within Brunei Darussalam government schools. It has proved adaptable with groups of students at the microlevel, notably in isolation with a single activity with more than one class (Appendix C) and with a single group of students over several activities (Appendix D).

Although teachers have always been able to construct microlevel instruments, their busy schedules tend to limit the time for them to form surveys and to process responses. The SPAID package offers classroom teachers in Brunei Darussalam an option for immediate use with groups of students. It requires 10 minutes for students to complete at the end of the activity and under 20 minutes for teachers to process using the computer template that may be found on the floppy disk accompanying this thesis. The increasing availability and versatility of computer spreadsheet programs makes the use of microlevel instruments such as SPAID more viable for classroom teachers. Opportunities are open for a burgeoning field of research into influencing the climates of classrooms and education through the use of microlevel weather changes that are instigated and controlled by classroom teachers.

Synthesising SPAID Within Existing Instruments

The SPAID package has provided teachers with information pertinent to their own teaching programmes that operated in relative isolation from those of other teachers, a general characteristic noted in teachers' work environments by Fullan and Hargreaves (1992). Microlevel instruments may also be potent tools for teachers who are interested and willing to engage in larger studies. Cycling through a procedure of assessment, feedback, discussions, intervention, and then reassessment, has been

used as a means of improving educational environments (Fraser & Fisher, 1986) (Figure 8).

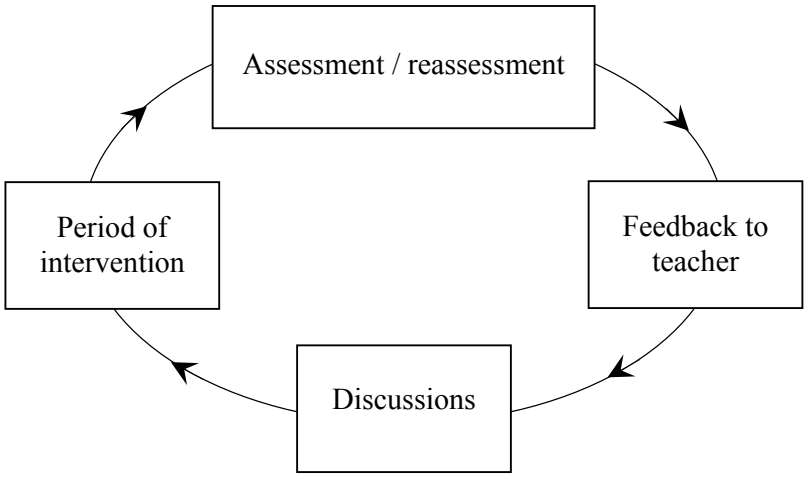


Figure 8. Cycle for improving educational environments.

SPAID and other microlevel instruments have a role in supporting these considered improvements over the time in which intervention occurs. As activities are engaged to bring about the envisaged types of changes, SPAID can provide teachers with immediate interim indicators of the worth of those activities (Figure 9). Students' reactions to these small-scale microlevel changes will furnish teachers with prompt indicators of progress. These accumulate to form the larger-scale improvements that are measured through the macrolevel instruments. Such amalgamation of macrolevel and microlevel instruments would provide teachers with a macrolevel objective supported by microlevel indicators furnishing feedback on each of their efforts to improve the teaching and learning that occurs with classes. In this manner, the SPAID package provides practical support to classroom teachers who attempt to convert the calls for educational changes into reality.

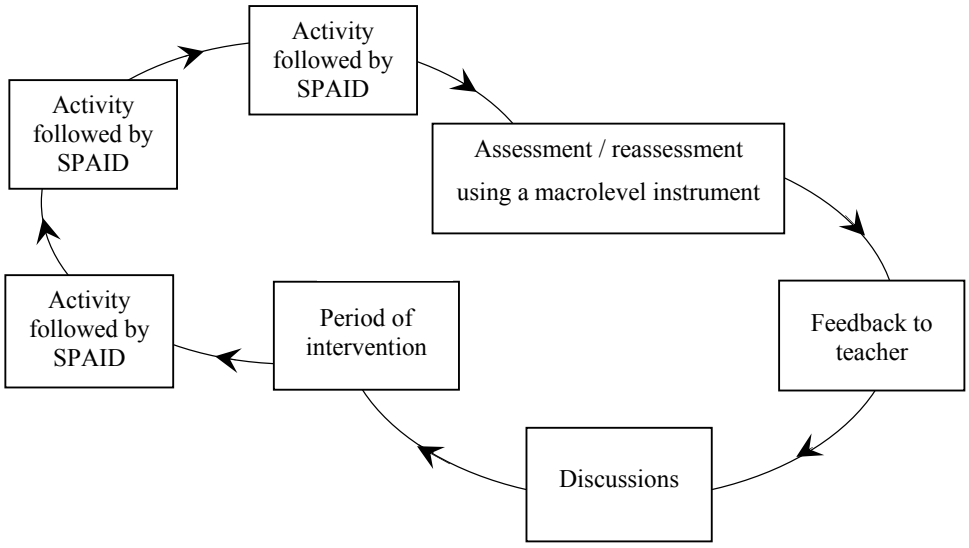


Figure 9. Integrating SPAID within a cycle for improving educational environments.

Summary

This study has developed the Students' Perceptions of an Activity Instrument and Display (SPAID) package, a microlevel instrument that provides teachers with indications of the perceptions of students from government secondary schools in Brunei Darussalam about new teaching and learning activities. A set of criteria was established to improve the viability of the SPAID package for classroom teachers and trials of the SPAID package proved it to satisfy the requirements. These included minimal intrusion into existing classroom routines and teachers' time, being simple for students to complete and teachers to process, and the outputs being timely for teachers and readily comprehensible by them. Computer assistance with processing and displaying of responses was found necessary to achieve the criteria. The effort to overcome difficulties in establishing two linguistic versions of the SPAID instrument was vindicated by the number of students who responded using each of the versions.

Reactions to the information presented via the displays in the SPAID package and the students' responses to the open-ended item in the instrument indicated that teachers needed to infer alterations from students' responses rather than react to students' direct suggestions. Teachers preferred succinct information rather than detailed data as they sought improvements to activities that catered for the majority of students. The process of the SPAID package provided teachers with a structure to reviewing activities. It was able to operate independently of teachers and provided timely information that alleviated their concerns over students' reactions to activities. This enabled teachers to continue developing the activities with increased confidence in the worth of their own decisions.

This study has been seminal in the application of microlevel instruments that provide teachers in Brunei with specific and rapid information about individual activities that they use with students. The SPAID package proved versatile over a range of uses, indicating the ease and flexibility of computer-assisted processing and displaying of responses. Opportunities abound for teachers to widen the use of the package as they investigate improving the efficacy of specific activities with classes, as well as developing their own surveys and processing templates to reflect the natures of the students and the activities. By gaining confidence and experience at improving small-scale new ideas teachers may bring to reality the large-scale changes called for to develop the teaching and learning in Brunei Darussalam. The greatest crime would be not to try.

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APPENDICES

Appendix A Bahasa Melayu, English, and Teacher Versions of the Instrument Used within the SPAID Package

KAJI SELIDIK

Kelas ……
Tarikh ……
Aktiviti ……
Lelaki / Perempuan

Ini bukan ujian. Nama tidak diperlukan dan tidak ada jawapan betul atau salah.
Guru kamu akan mengunakan jawapan ini untuk mempertingkatkan aktiviti dalam darjah, jadi sila jawab secara jujur.

Kawan kamu akan memberikan jawapan mereka sendiri, sila jangan meniru.

ARAHAN
Di bawah ini dinyatakan beberapa ayat. Sebaik saja kamu membaca fikirkan tentang aktiviti yang telah kamu lakukan. Bagaimana pandangan kamu tentang aktiviti itu, jika dibandingkan dengan apa yang kamu biasa lakukan di bilik darjah?.

Jika kamu fikirkan ayat ini **lebeh banyak** betul dari biasa, bulatkan **4**.
Jika kamu fikirkan ayat ini **banyak sedikit** betul dari biasa, bulatkan **3**.
Jika kamu fikirkan ayat ini **kurang sedikit** betul dari biasa, bulatkan **2**.
Jika kamu fikirkan ayat ini **banyak kurang** betul dari biasa, bulatkan **1**.

Jika kamu ingin menukar jawapan yang di berikan, potong saja dan bulatkan jawapan baru.

	Jangan lupa untuk membuat bulatan bagaimana pandangan kamu tentang aktiviti ini	Lebeh banyak dari biasa	Banyak sedikit dari biasa	Kurang sedikit dari biasa	Banyak kurang dari biasa
1U	Aktiviti ini menolong saya memahami apa yang perlu saya pelajari.	4	3	2	1
2C	Saya faham arahan yang diberikan oleh guru itu.	4	3	2	1
3R	Aktiviti ini adalah berfaedah bagi diri saya.	4	3	2	1
4W	Saya sudah mencuba sedaya-upaya saya membuat kerja itu.	4	3	2	1
5E	Aktiviti yang saya buat itu menyeronokkan.	4	3	2	1
6U	Aktiviti ini dapat membantu saya untuk menerangkan kerja ini kepada kawan saya.	4	3	2	1
7C	Saya faham bagaimana saya harus melakukan aktiviti itu.	4	3	2	1
8R	Aktiviti ini dapat membantu saya dalam matapelajaran ini.	4	3	2	1
9W	Saya rasa gembira membuat kerja itu kerana ianya berguna.	4	3	2	1
10E	Saya suka membuat lebih banyak aktiviti seperti ini.	4	3	2	1
11U	Aktiviti ini akan membantu saya membuat persedian untuk menghadapi ujian.	4	3	2	1
12C	Saya keliru mengenai apa yang perlu kami buat dalam aktiviti itu.	4	3	2	1
13R	Aktiviti tersebut berguna untuk saya mengadapi ujian.	4	3	2	1
14 W	Saya mahu membuat kerja yang diberikan seperti aktiviti ini.	4	3	2	1
15E	Aktiviti ini menjemukan.	4	3	2	1

Saya rasa aktiviti yang kami telah buat itu akan lebih baik sekiranya ……
……

Terima kasih kerana mengisikan semua ruangan dalam borang ini dengan jujurnya.

SURVEY

Class ……
Date ……
Activity ……
Male / Female

This is not a test. No names are required and there are no right or wrong answers.
Your teacher will use your responses to improve class activities so please answer honestly.
Your friends will give their own answers so do not copy what they put.

DIRECTIONS

Below are some statements. As you read them think about the activity you did. How do you feel about that activity compared with what you consider to be usual for this class?

If you think the statement is **a lot more** true than usual, circle **4**.
If you think the statement is **a little more** true than usual, circle **3**.
If you think the statement is **a little less** true than usual, circle **2**.
If you think the statement is **a lot less** true than usual, circle **1**.

If you change your mind about an answer, just cross it out and circle your new answer.

Remember to circle how <u>you</u> feel about the activity that you have done.		A lot more true than usual	A little more true than usual	A little less true than usual	A lot less true than usual
1U	The activity helped me understand what I need to learn.	4	3	2	1
2C	I understood the instructions that the teacher gave.	4	3	2	1
3R	The activity that I did is useful.	4	3	2	1
4W	I tried my best to do the work.	4	3	2	1
5E	I enjoyed doing this work.	4	3	2	1
6U	This activity would help me explain the work to a friend.	4	3	2	1
7C	I understood how I had to do the activity.	4	3	2	1
8R	The activity I did will help me in the subject.	4	3	2	1
9W	I was happy to do the work because it was useful.	4	3	2	1
10E	I want to do more work like this.	4	3	2	1
11U	This will help me remember what I need to know for my tests.	4	3	2	1
12C	I was confused about what we were to do in the activity.	4	3	2	1
13R	What I did in the activity is useful for doing tests.	4	3	2	1
14W	I wanted to do the work for this activity.	4	3	2	1
15E	The activity was boring.	4	3	2	1

I feel the activity we did would have been better if ……..

……..…….

Thank you for completing this form and for your honesty.

SURVEY– Teacher version

Class ……
Date ……
Activity ……

This is the teacher version of the survey asking students of their opinions of an activity you have recently completed with them.
You should complete this *before* finding the results of your students.

DIRECTIONS

Below are some statements. As you read them think about the activity you did. How do you feel about that activity compared with what you consider to be usual for this class?

If you think the statement is **a lot more** true than usual, circle **4**.
If you think the statement is **a little more** true than usual, circle **3**.
If you think the statement is **a little less** true than usual, circle **2**.
If you think the statement is **a lot less** true than usual, circle **1**.

If you change your mind about an answer, just cross it out and circle your new answer.

Remember to circle how <u>you</u> consider the students felt about the activity		A lot more true than usual	A little more true than usual	A little less true than usual	A lot less true than usual
1U	The activity helped students understand what they need to learn.	4	3	2	1
2C	Students understood the instructions they were given.	4	3	2	1
3R	The activity that they did was useful.	4	3	2	1
4W	Students tried their best to do the work.	4	3	2	1
5E	Students enjoyed doing this work.	4	3	2	1
6U	This activity would help students explain the work to a friend.	4	3	2	1
7C	Students understood how they had to do the activity.	4	3	2	1
8R	The activity will help students in my subject.	4	3	2	1
9W	I was happy to do the work because it was useful.	4	3	2	1
10E	Students want to do more work like this.	4	3	2	1
11U	This will help students remember what they need to know for tests.	4	3	2	1
12C	Students were confused about what they were to do in the activity.	4	3	2	1
13R	What students did in the activity is useful for doing tests.	4	3	2	1
14W	Students wanted to do the work for this activity.	4	3	2	1
15E	Students found the activity boring.	4	3	2	1
	I feel the activity would have been better if ……..…. ……...				

Thank you for completing this form and for your honesty.

Appendix B Existing Instruments Surveyed for Use in this Study

Label	Title	Reference	Target group	Scales	Versions	Items	Cycle	Reversed items	Response options
AIM	Attributions in Mathematics (Prototype)	Sai & Veloo, 1996, pp. 55-58.	Secondary	Ability Success Ability Failure Effort Success Effort failure Task Success Task Failure Other Success Other Failure		40	Yes	No	Five: Strongly agree Agree Unsure Disagree Strongly disagree
CES	Classroom Environment Scale	Fraser & Fisher, 1983a, pp. 14-19, 48-52; Fraser, 1994, p. 497.	Secondary	Involvement Affiliation Teacher support Task orientation Competition Order & organisation Rule clarity Teacher control Innovation	Actual	90	Yes	Yes	True/False
CLES	Constructivist Learning Environment Survey	Taylor, Fraser, & White, 1994.	Secondary	Personal relevance Student negotiation Shared control Critical voice Uncertainty	Actual/ Preferred. Long	42	Yes	No (nearly all)	Five: Almost always Often Sometimes Seldom Almost never
	(Revised)	Taylor, Dawson & Fraser, 1995.			Short	30	No	Yes	

(*table continues*)

Label	Title	Reference	Target group	Scales	Versions	Items	Cycle	Reversed items	Response options
CUCEI	College and University Classroom Environment Inventory	Fraser, 1994; Fraser, Treagust, & Dennis, 1986; Fraser, Treagust, Williamson, & Tobin, 1987.	Tertiary, Upper secondary: classes <30 students, not large lectures.	Personalisation Involvement Student cohesiveness Satisfaction Task orientation Innovation Individualisation		49	Yes	Yes	Four: Strongly agree Agree Disagree Strongly disagree
ICEQ	Individualised Classroom Environment Questionnaire	Fraser & Fisher, 1983a, pp. 33-38. Fraser & Fisher, 1983a, p. 66.	Secondary	Personalisation Participation Independence Investigation Differentiation	Actual/ Preferred. Long Short	50 (10 per scale) 25	Yes Yes	Yes Yes	Five: Almost never Seldom Sometimes Often Very often
KMLCQ	Kieler Motivational Learning Climate Questionnaire	Bolte, 1994, pp. 182-192.		Satisfaction Comprehensibility /requirements Subject relevance Students' opportunities to participate Class cooperation The individual student's willingness to cooperate	Real/ Today/ Ideal.	21	No	No	Seven: Complete the sentence by indicating on a seven-point scale. Very useful [ ] [ ] [ ] [ ] [ ] [ ] [ ] not useful

(*table continues*)

Label	Title	Reference	Target group	Scales	Versions	Items	Cycle	Reversed items	Response options
LEI	Learning Environment Inventory	Fraser, 1994, p. 497; Fraser & Fisher, 1983a, pp. 7-11, 39-43.	Secondary	Cohesiveness Friction Favouritism Cliqueness Satisfaction Apathy Speed Difficulty Competitiveness Diversity Formality Material environment Goal direction Disorganisation Democracy		105 (7 per scale)	Yes	Yes	Four: Strongly disagree Disagree Agree Strongly agree
MAS	Mathematics Attitude Scale	Sai & Veloo, 1996, pp. 62-64.	Secondary	Anxiety Self-concept Enjoyment Confidence		40 (10 per scale)	No	Yes	Five: Strongly agree Agree Unsure Disagree Strongly disagree

(*table continues*)

Label	Title	Reference	Target group	Scales	Versions	Items	Cycle	Reversed items	Response options
MBS	Mathematics Belief Scales	Sai & Veloo, 1996, pp. 59-61.	Secondary	Increasing math ability through effort Understanding problem solution in mathematics Solving time-consuming mathematics problems Solving mathematics problems using step-by-step procedures		24	No	Yes	Five: Strongly agree Agree Unsure Disagree Strongly disagree
MCI	My Class Inventory	Fraser & Fisher, 1983a, pp. 12-14, 44-47 (38 item version). Fraser, 1989a; 1994, pp. 497-8, 533.	Elementary-junior high. Students with reading difficulties.	Cohesiveness Friction Satisfaction Difficulty Competitiveness		38 25	Yes	Yes	Yes/No
QTI	Questionnaire on Teacher Interaction	Wubbels, 1993.	Primary, secondary	Leadership Helpful/friendly Understanding Student responsibility and freedom Uncertain Dissatisfied Admonishing Strict	Long/Short. Actual/ Preferred.	48	Yes	No	Five divisions: Never → Always 0 1 2 3 4

(table continues)

Label	Title	Reference	Target group	Scales	Versions	Items	Cycle	Reversed items	Response options
SLEI	Science Laboratory Environment Inventory	Fraser, Giddings, & McRobbie, 1992; Fraser, Giddings, & McRobbie, 1995; Fraser, McRobbie, & Giddings, 1993	Senior secondary	Student cohesiveness Open-endedness Integration Rule clarity Material environment	Personal/ Class. Actual/ Preferred.	35	Yes	Yes	Five: Almost never Seldom Sometimes Often Very often
SLEQ	School Level Environment Questionnaire	Fisher & Fraser, 1990a,b; Fraser, 1994, p.534.		Student support Affiliation Professional interest Staff freedom Participatory decision making Innovation Resource adequacy Work pressure	Actual/ Preferred.	56	Yes	Yes	Five: Strongly agree Agree Neither Disagree Strongly disagree
TOSRA	Test of Science-Related Attitudes	Fraser, 1981b.		Social implications of science Normality of scientists Adoption of scientific attitudes Enjoyment of science lessons Leisure interest in science Career interest in science		70	Yes	Yes	Five: Strongly agree Agree Not sure Disagree Strongly disagree

Appendix C Evaluation of SPAID with a Typical Activity

Appendix C describes the evaluation of the Student Perception of Activity Instrument and Display (SPAID) as it was used to help me as a classroom teacher improve the efficacy of an activity that was iterated with more than one class. It is common practice in Brunei Darussalam to allocate teachers several classes of the same level and for these classes to engage content topics concurrently. In this instance I had two Form Four classes and the presentation of any activity to one class could be altered before being repeated with the other class. This is considered a typical sample (Merriam, 1998, p. 62) for which teachers could employ SPAID in Brunei Darussalam. The focus of this appendix is the ability of the SPAID package to provide me with appropriate information to assist my effecting changes between engaging different classes in the same activity.

Appendix C begins with a review of some incentives and inhibitions teachers in Brunei Darussalam face should they engage classes in a new activity. A trigonometry activity is described together with some frustrations from a previous attempt that left me as the teacher lacking indications for improvement. The appendix then focuses on my use of the SPAID package when considering alterations to the activity between iterating the activity with two classes. The conclusion section contains benefits and limitations that were noted while using SPAID.

Incentives and Inhibitions to Attempt Changes

Incentives for the development of conceptual knowledge have been noted by Eisenhart and others (1993) to be informal, while those for procedural knowledge are encased in institutional accountability. Teachers in Brunei face similar situations as they encounter conflicting forces that simultaneously promote and discourage their attempts to develop conceptual understanding with students.

Incentives. There are several incentives for teachers in Brunei Darussalam to introduce new and varied ideas into their praxes. These include opportunities to attend conferences and professional development courses, reports from school inspectors, as well as articles in the national English language newspaper (Appendix E). Allocating teachers multiple classes at the same level which engage in the same content concurrently provides an incentive for attempting new activities as the sometimes considerable time required for development and preparation to establish an activity can be utilised for each of the classes.

Inhibitions. Traditional examinations and tests are central to the Brunei education system. Attempts by teachers to introduce changes to their teaching and learning practices need to dovetail into these assessment methods that commonly rely upon questions that often require recall of processes rather than conceptual knowledge and understanding. Following all tests and examinations teachers are required to submit students' marks to school administrators. Scores less than 50% are highlighted or written in red and those 50% or higher written in dark coloured ink. Class averages are calculated to 2 decimal places and students' percentage scores become public knowledge through being displayed on classroom walls. The transparency and close scrutiny of each set of results could inhibit teachers' enthusiasm to attempt variations from existing practices that might risk any lowering of results.

Tension for both students and teachers in secondary schools is greatly increased in years of external examinations. Towards the end of these years all external examination candidates are required to sit qualifying examinations that replicate their imminent external examinations. Students who have Brunei citizenship and who attain sufficient marks in the trial examinations have their

examination fees paid by the government. Should a student require an assessed grade for some reason, their qualifying examination results are used in the assessment process. Consequently, school tests and examinations play a highly influential role in students' schooling. The importance placed upon examinations connotes that teachers may be more likely to attempt variations from traditional activities with students in years other than those culminating in external examinations.

There is considerable safety for teachers in adopting the traditional teaching routines that students, teaching colleagues, school administrators, and parents have come to expect and respect. Students in Brunei Darussalam secondary schools may be justifiably wary of teachers who attempt unusual practices and they may become resistant to efforts that vary from their own preconceptions regarding what constitutes teaching lessons. Nevertheless, there are teachers who do attempt activities that are new to students. The remainder of this appendix provides an example of my attempt to provide students with experience at using trigonometry.

Trigonometry

The Mathematics Syllabus for Brunei Darussalam introduces trigonometry to students in Form Three through a section entitled "Applications of Trigonometry" (Curriculum Development Department, 1994, p. 28). Textbook and examination questions are often based upon what writers may consider to be real life situations, founded in the need to know about ships at sea, heights of cliffs and trees, and such like. I, as the researcher and the teacher, agree with Kempa (1997) by considering that involvement of students in practical activities can enhance their learning.

Connecting the two-dimensional world of textbooks and examinations to the everyday world around them must be a difficult step for students. The second

learning aim of the O-Level examination is "acquire and apply skills and knowledge relating to number, measure and space in mathematical situations that they will meet in life" (University of Cambridge Local Examination Syndicate, 1999b, p. 4). Comments published in the report on the A-Level examinations for November 1998 stated that students had difficulty grasping the basic details of a given real world situation and made wrong assumptions (University of Cambridge Local Examinations Syndicate, 1999a). Although these comments relate to the Form 6 examination to which successful O-Level students progress, they serve as a warning that even successful O-Level candidates may lack practical experience at applying their mathematics. The activity described in this appendix was intended to address this situation.

The Form 4 trigonometry section began with a revision of Form 3 content and this led me to engage both of the Form 4 classes I was teaching in a hands-on trigonometry activity outside the classroom. My intention was to encourage students' conceptual understanding through lending meaning to the theoretical procedures, to introduce practicality and sensibility into the students' 2-dimensional textbook and examination world.

The Activity

Students in groups of three were required to undertake three related mathematical tasks, each task providing a height of the same object. First, the students visually estimated the height of the object. This was done by standing a distance from the object and comparing the height with a 1-metre ruler placed vertically at the base of the object. Second, students constructed a scale diagram by measuring a distance from the base of the object and a corresponding elevation. Third, students calculated the height using trigonometrical ratios with the same data

gathered for the scale diagram. An attractive feature of this activity is its potential to generate a host of concepts applicable to any level of student competence; awareness of sensible results, the need for gross-error checks, identification of merits and limitations of the different methods, averaging multiple readings, relative errors through changing one variable, and so on.

Students were given a worksheet that outlined the requirements of the three tasks. At the site of the activity I also explained and demonstrated the procedures to the students. Students in Brunei generally have limited experiences with practical mathematical activities so more direct instructions were issued to students than I would have preferred. Long-term aims of such activities included the development of initiative, the ability to work collaboratively, and completing tasks with minimal supervision or direction. Where possible, these ideas were encouraged and fostered with individuals as the activity progressed.

Previous Attempts with Unforeseen Difficulties

A previous attempt to use this trigonometry activity in Brunei Darussalam with three classes of students left me in doubt about how to improve the activity. Differences in the perceptions of students and even experienced teachers of the same classroom environment have been noted (Fisher & Fraser, 1983a; Fraser et al., 1992; Wubbels, 1993) and these can influence the outcomes of activities. This point had been reinforced when a group of students was reluctant to become involved. As a foreign teacher I was uncertain if I had transgressed a social norm. To have done so had the propensity to influence the outcomes of the activity by driving a wedge between the intent of the activity and students' willingness to participate (Fullan, 1991; Fullan & Hargreaves, 1992; Kyle et al., 1991; O'Loughlin, 1992). Investigation into reactions of individual students was hindered through linguistic

barriers to communication and the need for me to manage the routine tasks of teachers; clarifying instructions, encouraging students, redirecting attention, and so on.

Evaluation and improvement of the activity. It was difficult to obtain an evaluation of this early attempt at the trigonometry activity. It was designed to be a simple event within my teaching programme and I was not interested in engaging in a test-activity-retest cycle that would have absorbed more time than I was willing to allocate. Improved examination results were a desired consequence of the experience but there were other aspects of the activity important to me that could not be discerned through percentage marks. I held that the activity would have been worth the effort should students have confirmed their understanding of the use of trigonometry, believed the tasks to be useful, or even merely enjoyed doing the tasks.

Indications for improvements to the activity remained abstruse following students' completion of tasks. There were few opportunities to stand back and consider students' participation, so my impressions of their engagement and the efficacy of the activity were highly subjective. When the three classes had completed the trigonometry activity and returned their worksheets a few days later, my overall impression was that students had failed to develop the desired connections between the textbook processes and their outdoor experience.

This view was reinforced when marking the classes' answers to a tree-height examination question a few weeks later. The colleague who wrote the examination had included the question without my knowledge, later informing me that he had added it for my benefit. Although he did not show active interest while I was engaging classes in the activity he was clearly observant of what I was doing.

I felt that the presentation of the activity and the worksheet could be improved but lacked indications of how to do so. It was appreciated that benefits from the activity may have been behavioural or affective, and indications of students' perceptions of the activity may have provided me with suggestions for alterations.

I continued to believe the trigonometry activity to be a worthwhile endeavour in promoting students' practical and conceptual understanding of trigonometry, regardless of the paucity of tangible evidence or observable rewards. Consequently, I engaged two different Form Four classes in the same activity to consolidate their revision of earlier trigonometrical content. If I were to improve the activity and its presentation, then a viable means of identifying directions of improvement was needed. The SPAID package was used with these two new classes in an effort to obtain timely and relevant information for improving the efficacy of the activity.

Method

Two Form Four classes from an all-boys school at which I was teaching engaged in the trigonometry activity to consolidate their revision of Form Three content and to provide students with experience applying trigonometry. Students of both classes, Class 1 and Class 2, were enrolled in the O-Level syllabus with the final examination scheduled to be sat at the end of the following year. Classes in the school were grouped according to their subject choices and previous examination results. The syllabus content of this examination was academically demanding for students in both classes. Class 1 was engaged in the trigonometry activity after which both the students and I completed the respective student and teacher versions of the SPAID survey.

Results from the computer template from Class 1 were considered before undertaking the same activity with Class 2 the following day. My ability at the first languages of the students was limited, as was the English ability of the students. This evaluated the ability of the SPAID package to form a conduit through which students could relate their reactions to the activity, overcoming the language barrier at the time. The effectiveness of SPAID was dependent upon the extent to which I found the information useful in considering alterations for improving the efficacy of the activity.

The responses to the survey, the graphical displays, and my interpretations of the data were shown to two teachers who taught at other schools in Brunei Darussalam. This was to keep a check on the personal bias that I brought to interpretations of students' responses and to attempt constancy between what I said was being done, what I appeared to do, and what was done (Merriam, 1998, p. 43). One was a teacher of mathematics with whom I had previously taught and the other was a teacher of science with whom I had not taught. In the past they had both provided critical appraisal of my work and I valued highly their comments and dogged desire to ensure my actions and reactions were realistic within the teaching environments of government schools in Brunei Darussalam.

Results

Class 1

Class 1 required fewer than 10 minutes to complete their responses to the survey and it took me 10 minutes to process their responses. 12 of the 19 students responded using the Bahasa Melayu version of the instrument and the remaining 7 used the English version. Although the activity was not to be iterated until the

following day with Class 2, there was limited available time in which to consider the results that were obtained from Class 1 and I allotted 15 minutes between teaching periods for this task. Figure 10 gives the graphical summary of responses for the five SPAID categories.

Beginning. The teacher's caution

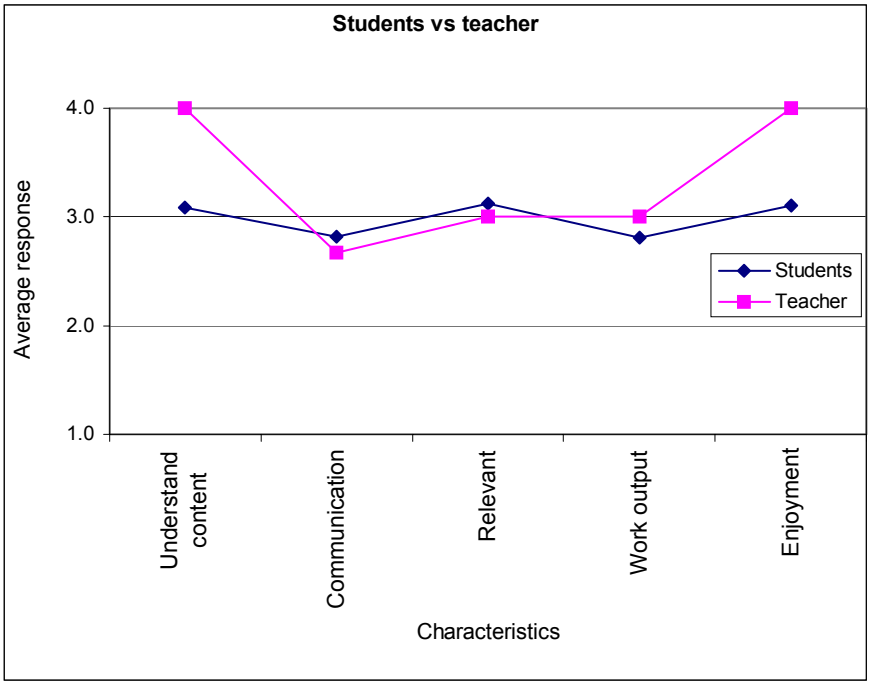

Figure 10. Summary of responses of Class 1 and teacher for the five SPAID characteristics.

From the graph in Figure 10 of students' responses I concluded that the class considered the activity favourably in comparison to their perception of normal mathematics classes. Significant difference between the students' perceptions of the activity and my estimation of their perceptions was apparent in the two characteristics of Understand Content and Enjoyment. In conjunction with the close estimation of Communication, these differences suggested to me that students thought they had a reasonable understanding of what they were to do but had not

considered that the activity had clarified their understanding of the content to the extent to which I consider it should. Enjoyment provided another difference of perspective, with the category average 3.1 for students and my overestimated average of 4. This misjudging was not a major concern to me, but it did prompt me to attempt to scrutinise students' enjoyment closer when engaging the second class in the trigonometry activity.

Open-ended comments and teacher's reactions. My responses to the open-ended item at the end of the instrument and those of the Class 1 students are listed in Table 8. Seventeen out of the 19 students in the class added written comments, which was a higher proportion than I expected. Eleven of these comments were in the Bahasa Melayu language, which highlighted a limitation for teachers who are not familiar with the first languages of the students. Obtaining translations required time and the ready assistance of a translator, in this instance a teaching colleague.

Table 8

Class 1 Students' and Teacher's Written Responses to the Open-Ended Item

Teacher	*I feel the activity we did would have been better if...*
	I used markers to indicate the origins of measurements. Students had difficulty understanding my verbal locations, such as *base of the wall*, *directly below*.
Students	*I feel the activity we did would have been better if...*
1	(Translated) more practical than lecture.
2	(Translated) being done (carried) all the time.
3	(Translated) to be including in all our studies but could be time consuming.
4	(Translated) more of this type of activity to be organised.
5	(Translated) did it more seriously.
6	(Translated) being repeated all the time.

(*table continues*)

Students	*I feel the activity we did would have been better if…*
7	(Translated) teacher is able to supervise and explain with better clarity.
8	(Translated) often repeated.
10	(Translated) I do it more seriously.
11	(Translated) it is being done outside the school compound.
12	(Translated) not too serious.
13	Doing a lot of practise so, we can have the experience and get well in exam.
14	It done once more by practise.
16	Me understand.
17	They do not frequently.
18	The teacher scolded us strictly enough so we can concentrate it.
19	We are going to Mumong – because at there I can do better and make me more active in my subject.

I considered the comments to be favourable towards the activity and no comment was deemed as negative. Seven students' comments seemed to indicate that they desired more activities of this nature (Students 2, 3, 4, 6, 8, 13, and 14). Four students offered discipline comments, three suggesting tighter control and removal of freedom (Students 5, 7, and 18) and one considered as possibly the opposite (Student 12). Some conflicting opinions appeared to exist between comments that suggested the need for students to be more serious (Students 5 and 10) and Student 12's comment "not too serious".

Improving students' affective attitude toward mathematics was a desirable outcome of the activity and I did not consider rigid discipline as conducive to that design. In contrast, the responses suggested to me that the students might equate strict discipline and limiting freedom with good teaching and learning. If I wanted students to take the activities seriously and to appreciate the mathematics involved I may have needed to conduct sessions in a manner more rigid than I would prefer.

Students' written responses indicated that several desired further practice, implying that they may have benefited from a slower pace through the tasks and more demonstrations of what was required. Time restrictions, whether real or perceived, are always influential on the actions of teachers and I was loath to use more than a single session to complete this activity out of the three available each week for teaching the class. Rather than absorbing more time to repeat the activity, I looked for ways of improving the use of the allotted time.

Student 19's comment, "We are going to Mumong – because at there I can do better and make me more active in my subject", was curious to me as I had attempted to provide an opportunity for the class to be more active in their learning. Mumong is a town in another district in Brunei and the intent of the comment remained unclear, especially as no student did transfer out of the class.

Limited linguistic communication. The responses of some students provided uncertainty. The translated comment by Student 12, "not too serious", could be considered to contradict the responses of Student 5, "did it more seriously", and Student 10 "I do it more seriously". Cognisant of the difficulties some students in the class experience expressing themselves through writing, with linguistic latitude Student 12's comment may be inferred to mean that the activity would have been better if the student had been more serious at the time. However, I was mindful of resisting the urge to infer too much from students' comments for fear of my own preferences supplanting their intentions. Consequently, the real intent of Student 12 remained unknown. Discussing unclear students' comments with the colleague translator proved to be useful, even if it confirmed the ambiguity of comments.

Some comments provided me with little formative information and left more questions than solutions. The open-ended response by Student 1, "more practical

than lecture", and "they do not frequently" by Student 17 are examples. However, these students did take the time to make their comments and my not having a better understanding of their intent was regretted. Given the time restraints of teaching, comments such as these were pondered, and then put aside.

Anonymity. The anonymity of students' responses to the survey removed the opportunity to trace comments to authors. On a previous occasion in Brunei I had attempted to discuss students' reactions to an activity (Nannestad, 1997) and found that their responsiveness and willingness to provide honest responses was considerably enhanced through anonymity. In addition, communication between students in Brunei Darussalam government secondary schools and the foreign teachers contracted to teach in classrooms is limited when they have no common language in which both have confidence and competence. Consequently, attempts to discuss issues can be considerably protracted and uncertain. An additional obstruction to teachers discussing responses with students prior to iterating the activity with another class is the practice of undertaking the same content in concert with multiple classes. In this instance I did not have an opportunity to discuss the responses of Class 1 with the contributing students prior to iterating the activity with Class 2. This example reflects classroom reality, and provided an example of teachers being left to form opinions based upon whatever information they have available.

Teacher's Conclusion

Differences in responses to the Understand Content and Enjoyment characteristics, the similarities in the Communication and Relevance categories, together with students' written responses, gave me the impression that the students

considered they had reasonable understanding of what they were to do, but had had trouble gaining the benefit that undertaking the activity had intended.

Class 2

Alterations to the activity. Teachers' perceptions of a class can influence the presentation of any activity to that class. The second class to engage in the activity was viewed by the school administration as less academically inclined than Class 1. This view was supported by test and examination results. My initial feeling prior to engaging Class 2 in the trigonometry activity was that they would be less likely than Class 1 to connect the relevance of the activity with their textbook mathematics and less appreciative of efforts to provide activities that vary from traditional classroom routines.

The responses from the first class prompted more emphasis with Class 2 on attempting to link the activity to the theory and two dimensional diagrams in the test book. I broke the tasks into even smaller stages than for Class 1 and demonstrated each in turn. Changes included using coloured sticks of chalk for drawing diagrams on concrete, using some sheets of brightly coloured card for indicating key points, and simplifying instructions even further. Verbal directions were altered to contain fewer linguistic challenges for the students. A direction such as "From directly under the tallest point" was altered to the linguistically simpler "From the orange card". The chalk and cards were simple to obtain but would not have been thought of without considering Class 1 students' responses to the SPAID package.

Category summary. Students from Class 2 similarly required fewer than 10 minutes at the end of their session for the 21 students to complete responses to the survey. 17 students responded using the Bahasa Melayu version and the remaining 4 used the English version. It took seven minutes to enter the responses into the

computer and Figure 11 shows the graphical summary. The average response for Understand Content by the Class 2 students was higher than I estimated which was pleasing and I hoped that some of the changes in presentation may have contributed to this. My continued overestimation of students' enjoyment, with my average of 3.7 compared with students' 3.2, indicated that I had more to learn about interpreting students' actions and behaviours. However, the impression was that students' responses were still positive towards the activity, and that the use of the activity had been a worthwhile endeavour.

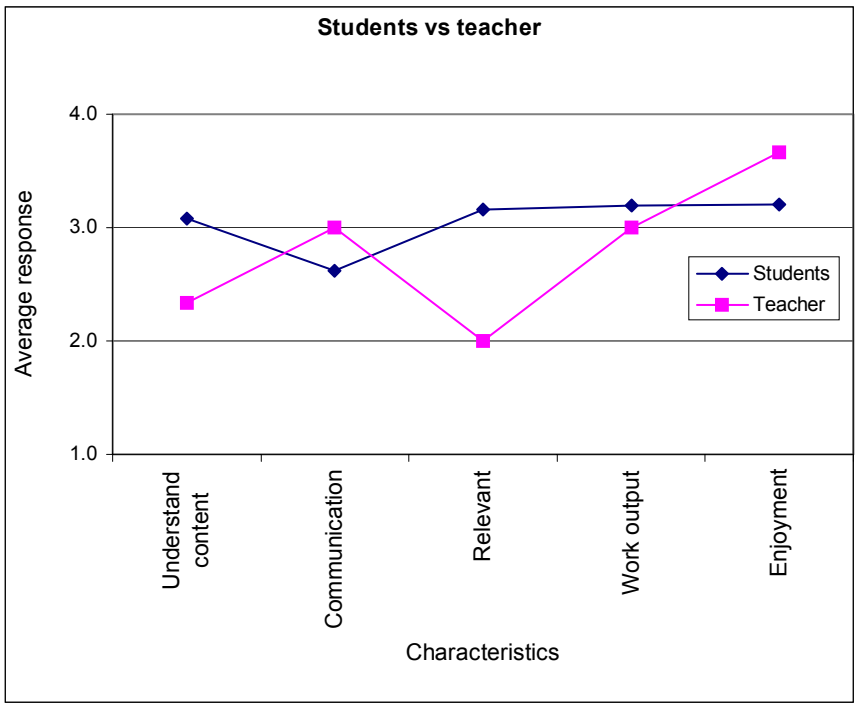

Figure 11. Summary of responses of Class 2 and teacher for the five SPAID characteristics.

Disparity between the responses to the Relevance characteristic by the students and myself provided the greatest surprise for me. It suggested that my preconceived doubt over the class's reception of this activity may have been in error

and prompted the resolution to try other activities with Class 2 in the future. This was viewed as a significant boon from the use of the SPAID package.

Open-ended comments and teacher's reactions. My response to the open-ended item at the end of the SPAID survey together with those by Class 2 students are listed in Table 9. Of the 21 students, 17 provided responses, with 13 using Bahasa Melayu language and 4 using English. I again considered this to be a high proportion of the students in the class, who were generally reluctant in their communication with me. This was viewed as a positive indicator of students' interest in providing responses. The same teaching colleague as for Class 1 obliged by providing translations of students' local language responses into English. On this occasion there was a delay of a few days before he completed the translations, which would have prevented including local language open-ended responses if I had further iterated the activity with another class.

Table 9

Class 2 Students' and Teacher's Written Responses to the Open-Ended Item

Teacher	*I feel the activity we did would have been better if...*
	One step at a time Plenty of demonstrating This is a "difficult" and noisy class doing a syllabus for which they are not suited. BUT when they were presented with the survey, every one was serious, silent and diligent at completing the form – very reassuring.
Students	***I feel the activity we did would have been better if...***
1	We listen what the teacher say and must consentred.
2	We go to the grandstand to do the work/ going to a field doing a project.

(*table continues*)

Students	*I feel the activity we did would have been better if…*
3	We do it every week.
4	The teacher explain step by step because sometimes student didn't understand what the main point the teacher said.
5	(Translated) I understand this activity.
6	(Translated) it is taught slowly.
7	(Translated) I try to concentrate.
8	(Translated) I do work which is beneficial.
10	(Translated) the activity keeps going.
11	(Translated) it is being taught slowly.
12	(Translated) we study seriously.
13	(Translated) do it well.
14	(Translated) to be continued for as long as possible and that students who come after us can also do likewise.
16	(Translated) we always study.
19	(Translated) study together.
20	(Translated) teacher will explain more.
21	(Translated) if students do not make too much noise, if all can understand what is being taught, if noisy, how can we understand what is being taught.

All students' comments were considered to be supportive of the activity and none to be openly critical. Four comments desired more of this style of activity (Students 2, 3, 10, and 14). Seven students' comments indicated difficulty with understanding the instructions (Students 1, 4, 5, 6, 7, 11, and 20). Extra emphasis was placed with Class 2 on parcelling the activity into small incremental steps, demonstrating each in turn, and illustrating requirements of the tasks in the worksheet. The difference between the students' average response to the items in the Communication characteristic and my estimation of their responses (Figure 11), was noted but I initially judged it to be sufficiently small not to incur closer

consideration. More marked differences in other characteristics attracted greater interest. In contrast, having seven comments concerning the need for an even slower pace of work was considered significant. These, together with an average response of 2.6 for Item 12 (*I was confused about what we were to do in the activity*) suggested that many of the students were still unsure about the requirements in spite of the extra effort to simplify instructions. The simplification of instructions may have assisted students' understanding of the task's requirements but a myriad of other factors obfuscated their comprehension, pointing to the students' learning difficulties in this situation being particularly multifarious.

Uncertain intention. Several students' comments appeared uncertain regarding intention. Student 21's comment on noise conflicted with my insistence that students be quiet and attentive during explanations and demonstrations. The response by Student 19, "study together", pointed to group work, which this activity required. The language ability of students in Class 2 was more limited than those in Class 1, and it was possible that students' comprehension of the stem of the open-ended item might have been alternative to mine.

Anonymity of responses again prevented clarification of individual students' understanding of the open-ended stem. During the next teaching period with Class 2 I presented all their open-ended comments to the class in an effort to identify the purposes of uncertain comments. Attempts to obtain students' interpretations of the open-ended responses were thwarted through linguistic barriers.

Changes following reviewing Class 2 responses. My interpretation of the graphs and students' comments available through the SPAID package was that the students in Class 2 were appreciative of the outdoor trigonometry activity, but had difficulty carrying out the tasks, as did Class 1. Responses to the characteristics of

Understand Content and Relevance were considered significantly above my estimations, sending a signal not to underestimate the students' ability to appreciate activities in spite of their difficulties understanding instructions and their comparatively low results in tests and examinations.

As a consequence of my interpretation of the Class 2 students' responses I resolved to attempt more activities and demonstrations of syllabus content with Class 2. Students' comments suggested they were likely to require more explicit directions than I would prefer to give, being broken into small incremental steps. In addition they would prefer more time to undertake activities than I would usually be willing to commit. There is a sound argument to undertake future activities with Class 2 twice, the first being used to give students an idea of the requirements and the second to enable students to focus on the mathematical content and to complete the tasks. However, care would be needed to placate concerns from school administrators, parents, and the students themselves that appropriate progress through the syllabus was being maintained.

Evaluation of SPAID

Administration and Processing

The two classes each took under 10 minutes at the end of their lessons to complete the SPAID survey. This period of time proved useful to collate the equipment that was used during the activity. Processing of students' responses required 10 minutes and 7 minutes for Classes 1 and 2 respectively. Of the 40 students in the two classes, 29 responded using the Bahasa Melayu version and 11 students used the English version, which vindicated the effort to have the two versions established and available. Students were willing to contribute and all

students returned their surveys. 34 out of the 40 students responded to the optional open-ended item at the end of the survey and none of the students' comments was regarded as inappropriate.

Alterations

I allocated about 15 minutes in which to consider students' responses and changes for iterating the activity with Class 2 the following day. Whilst the initial time to consider responses was limited, the overnight delay enabled alterations to be mulled over.

The discrepancies between my estimations of students' responses and the averages of their responses to the five characteristics reminded me of the differences that can exist between students' and teachers' perceptions of the same learning environment. Two topics that arose from this example related to discipline and enjoyment, which may be indicative of possible preferred learning styles for students in Brunei Darussalam.

My underestimation of Class 2's responses to items in the Relevance characteristic provided a clear example of the advantage of balancing a teacher's subjective impression with an alternative assessment. While engaging the trigonometry activity may have had limited impact on raising the test and examination percentage marks of students, the affective influence should not be underestimated. The positive Relevance response to the practical activity from Class 2 was certainly significant to me. It encouraged me to retain this activity for use with other classes, and to continue selective collection of other activities that I would look to assimilate into my classroom praxis with students in Brunei Darussalam government secondary schools.

Idiosyncratic reactions dependent on class and student. My expectations of reactions for each class were influential on my presentation of the activity. The two classes were of differing abilities and they received different treatment. Data from the SPAID package enabled me to view reactions from Class 1 when I considered altering the presentation to the next class. Although these responses contributed to the alterations they did not dictate what occurred.

Juggling degrees of assistance was one of the continual decisions required of me and was based upon considerable subjective interpretation. The nature of the alterations I made was specifically applicable to Class 2. When using the activity again with another class the influence of any further changes will be idiosyncratically dependent on a myriad of factors; the school, the students on the day, the activity, and so on.

Idiosyncratic adaptations also applied at the individual student level. Not all students' queries during the activity were accorded equal assistance. Some students were provided with more definite guidelines than others, depending upon my judgement of that individual's capabilities to complete the tasks.

Such flexibility is necessary to cater for the individuality of the classes, the students, and the teaching contexts. This idiosyncratic nature of alterations did limit the extent to which the alterations may be transferred beyond the specific teacher and students.

Small changes. The design for using the SPAID package was to increase the efficacy of the trigonometry activity to provide students with positive learning experiences. Changes to the activity between iterations to improve the efficacy were neither startling nor dramatic. The attempts to improve the efficacy of small individual events were grounded in what Goldenburg and Gallimore (1991)

have described as “the mundane but very real detail of teachers’ daily work lives” (p. 69), considered to be a component of successful professional teacher development.

One immediate outcome I noted as the teacher was the absence of strong negative students’ reactions towards the trigonometry activity. This in itself was comforting to me, given the traditional modes of instruction with which students in Brunei are familiar. The types of changes called for in Brunei and noted in Chapter 2 of this study require time to occur. Improving the apparent effect of the trigonometry activity provided a small but positive shift in the direction of teaching called for in Brunei Darussalam. My gaining confidence and competence in one activity provided me with a slightly firmer base from which to consider and explore other ideas.

Sharing Ideas

Having gained insight into the use of the trigonometry activity with classes, my thoughts turned to sharing the idea and worksheet with other teachers. There were two other teachers at the school teaching the same level and content as Class 1 and Class 2. I offered copies of the worksheets to both teachers, who declined, stating that they were not interested and that they had their own worksheets.

The declining of my offers of worksheets conflicted with the responses by teachers in the survey by Wong et al. (1999) in Brunei Darussalam, which noted that the sharing of resources with other teachers had the highest mean amongst the items about concerns on the teaching profession. There are numerous resources available to teachers in Brunei Darussalam government schools, but as well as being receptive to considering them, teachers need to be willing to spend the time developing them for use with their particular classes and students if new ideas are to be effective. This instance perhaps indicates that there may be more of a difficulty with teachers accepting shared ideas than they care to admit.

Teachers' personal adaptations of an activity advances the development of ownership of that activity, which is believed crucial for teachers' adoption of change as well as being a means of increasing teacher satisfaction (Goldenburg & Gallimore, 1991). This suggests that my providing other teachers with a ready-to-use trigonometry worksheet may have limited impact, perhaps even being counter productive to those teachers making effective use of the gift. The requirement for teachers to modify the activity to suit their own perceived needs may be more conducive to developing ownership, hence the teachers' beliefs in the activity and their desires to make it work. In view of the idiosyncratic nature of the classes and situations, I now consider it might be preferable to provide teachers with ideas for use with their own classes, together with indications of difficulties encountered, rather than completed worksheets. The teachers need to modify the activities, engendering their personal interest and ownership.

Continued Belief in the Activity

Having engaged Class 1 and Class 2 in the trigonometry activity and considered the data made available through the SPAID package, my belief that the trigonometry activity formed a positive learning experience was reinforced. Students in Brunei are currently educated towards sitting traditional external examinations and they can understandably have difficulty accepting the content and intent of activities that deviate from their expectations of what is required to do well in this mode of assessment. This is heightened if their participation does not noticeably contribute to their final mark (Wilson, 1994). Although events such as the trigonometry activity may provide reinforcement of concepts, failure for their use to produce noticeable improvements in students' examination results may increase obdurate belief in existing teaching practices for students and teachers alike.

Official assessment of students' mathematical ability in Brunei Darussalam remains confined to traditional written examinations, limiting the measuring of students' ability and experience at applying mathematical concepts. Students and teachers ought to be forgiven by the authorities if they ignore the calls for change if attempts to inculcate mathematical experiences and practical ability are not recognised through formal or informal assessment. Unless there are means of tapping other domains, such as students' perceptions, the initial and small attempts at educational changes that teachers are encouraged to engage may too-readily dissipate without fair trials. The SPAID package provided me with a viable means of tapping one alternative evaluation of the trigonometry activity.

Open-Ended Comments

The open-ended comment within the SPAID survey was included to provide students with an opportunity to indicate potential improvements to an activity directly to the teacher. 34 of the 40 students in the two classes responded to the open-ended item, which was more than I expected. This was considered a positive indicator of students' interest, and all comments appeared to be genuine and none was considered inappropriate.

Two-edged translation. 24 of the 34 students who responded to the open-ended item in the survey used a local language while 10 responses were in English. This highlighted a major linguistic limitation for me as I was not able to communicate with students in their own languages. The need to obtain translations of the students' comments proved double-edged. On the limiting side, obtaining translations required the availability of both time and a willing translator, presenting barriers to the provision of timely information and interposing another person's

interpretation on the comments. I was fortunate to have the support of a teaching colleague who generously donated his time and talents.

A decidedly positive consequence of the need for translation was the need for collegial cooperation. This proved a relatively nonthreatening means for me to share the activity with a colleague. Fullan (1991) considered the sharing of ideas and collaboration as essential to individual development. My colleague was interested in using the activity but unfortunately did not have any classes with which he could do so that year.

Uncertain intention. Students' enthusiasm to offer written comments was gratifying but in some instances the responses to the stem, *I feel the activity we did would have been better if...*, were found puzzling. In these cases the comments did not contribute to my knowledge of their reactions to the activity.

Defined instructions. Students appeared reluctant to develop their own methods to complete tasks. SPAID data from Class 1 students led to giving Class 2 more definite guidelines to assist them to complete the tasks. Further pragmatic experiences and gradual exposure to opportunities for decision-making may increase students' willingness to develop their own methods.

Summary

This appendix has shown the Student Perception of an Activity Instrument and Display (SPAID) package would appear to be suitably viable tool for use by classroom teachers in Brunei Darussalam government secondary schools. It presented indications of the perceptions from one class of students towards an activity that were instrumental in altering delivery of the same activity to a second class.

The package proved to be practical for administering to classes and for processing via the accompanying computer graphing template. It also provided a conduit for communication from the students to me as the teacher, circumventing previous obstructions that had prevented me from identifying avenues for amelioration.

The open-ended item at the end of the SPAID proved two-edged. Students were willing to offer comments but the majority of responses was in the Bahasa Melayu language and needed translation into English before I could consider their impact. The translation requirement, however, did promote collegial cooperation.

Students' responses resulted in the simplification of instructions and the provision of more definite guidelines. Although this restrained opportunities for students to demonstrate initiative and to complete tasks with minimal supervision, it appeared to cause them less conflict with their expectations. My own impressions will always be influential in the presentation and evaluation of activities, but the SPAID package provided me with timely access to some perspectives of students that complemented my own impressions of events. Differences between my responses and those of the students provided constant reminders of the existence of these differences and the need for some vehicle to highlight them, a role for which the SPAID package proved highly suitable.

Appendix D Evaluation of SPAID in the Assessment of a Series of Atypical Activities

Appendix D evaluates the use of the SPAID package to help a group of teachers to evaluate an innovative project at a secondary school in Brunei Darussalam. This provides an example that strengthens the transferability of SPAID, showing "the extent to which the findings of a qualitative study can be applied to other situations" (Merriam, 1998, p. 153). The situation comprised a unique sample (Merriam, 1998, p. 62) that was atypical of usual activities in which classroom teachers in Brunei engage their students. This contrasts with Appendix C in which the SPAID was used with a typical sample that could readily occur. Such contrasting uses demonstrate the potential diversity of the SPAID package.

The focus of this appendix is a project that was a marked departure from existing practices within Brunei government secondary schools and was quite different to the course expected by Ministry of Education officials when they directed the college to conduct a Pre-Entry Form 6 Programme. The absence of traditional routines and evaluation procedures familiar to these administrators caused them some concern and the teachers involved desired an evaluation of the Project apposite to the ethos behind it.

Appendix D begins with an outline of the origins and rationale for the Pre-Entry Form 6 Programme that the school was directed to provide and the Project that the teachers wanted to run as part of the Programme. Then follow three examples of teachers using the SPAID package. These include the crucial first activity, a subject-based activity, and then the summary of responses used during the poster

presentation that closed the Programme. A summary of the viability of SPAID to provide teachers with appropriate information concludes this appendix.

Background

Sultan Omar Ali Saifuddien College (Maktab SOAS) is the oldest secondary school in the Sultanate of Brunei Darussalam and is located in central Bandar Seri Begawan, the capital and largest population concentration in the country. The school is currently a single-sex boys' establishment conducting morning sessions from 7:30 a.m. to 12:30 p.m. on each school day. Most secondary schools in Brunei cater for Forms 1 to 5 levels of education and the students who qualify to progress to a two-year Form 6 course of study are directed to one the few schools offering that level.

Form 6 Schools in Brunei Darussalam

Four schools under the Ministry of Education in Brunei Darussalam offer Form 6 courses of study towards the Cambridge Advanced-Level (A-Level) examinations. Selection of students for the élite Maktab Sains Paduka Seri Begawan Sultan, known as the Science College, is based upon primary school examinations. Thereafter these students remain at the Science College throughout their secondary education in Brunei, including their A-Level examinations. In 1996 the only other Ministry of Education school within Brunei that offered Form 6 courses was Maktab DPM Al-Muhtadee Billah Gadong, known as the Sixth Form College. This establishment caters solely for Form 6 students and rising numbers of students resulted in the Ministry of Education directing Maktab SOAS, and one other school that is located in another district of the country, to offer courses for Form 6 students in 1997. Form 6 courses had been commenced on other occasions over the history of Maktab SOAS to cater for the changing circumstances of the Sixth Form College and

the Science College. A separate school operated by the Ministry of Religious Affairs offers A-Level courses but is considered distinct from those operated by the Ministry of Education. As with the Science College, it is unusual for students to transfer to or from this school.

Current Form 6 courses at Maktab SOAS. The Form 6 Advanced-Level course of study consists of three subjects plus a General Paper or English Paper. An additional extension examination in mathematics, entitled Further Mathematics, is available for the most able and motivated mathematics students. Subjects available for the initial 1997 cohort of students at Maktab SOAS were restricted to chemistry, mathematics, and physics, together with a mandatory English in the form of either the A-Level General Paper or repeating the English O-Level examination. Owing to timetable restrictions, the extension Further Mathematics course was conducted outside normal school hours.

In Brunei Darussalam the Ministry of Education directs qualifying Form 6 students to a school rather than students deciding which school they will attend. The combination of restricted available subjects and selection of students enabled the 1997 Form 6 intake of 22 students at Maktab SOAS to comprise an academically highly capable cohort. The following year, 42 students started the year and Geography joined the list of available options. The range of subjects expanded further in 1999 to include biology, accounting, economics, and management of business. Art was offered as an optional extra out of school hours for interested students.

The Pre-Form 6 Programme

Rationale: The Wait for Results

The majority of students in Brunei Darussalam terminate their secondary school career by sitting the Form 5 Ordinary Level (O Level) examinations conducted by the University of Cambridge Examination Syndicate in England. These examinations operate twice a year to conform to the academic years of various countries. The main examination session for students in Brunei occurs in November each year with unsuccessful candidates able to repeat examinations in the middle of the following year. A wait of three or four months ensues before results are available. The Brunei academic year for secondary schools commences at the beginning of January and Form 5 students who continue on to Form 6 necessarily delay their studies while awaiting confirmation of examination results and placement in one of the schools offering Form 6 courses.

Officials at the Ministry of Education directed Maktab SOAS and other schools operating Form 6 courses to conduct Pre-Entry Form 6 Programmes at the beginning of 1998. The intention was to reduce the period of time between courses of study for potential Form 6 students. Applicants for these programmes were to be citizens of Brunei Darussalam rather than permanent residents or foreigners, and male at Maktab SOAS as it is a single-sex school for boys. Attendance was voluntary and students applied directly to the schools. This attempt faded at Maktab SOAS in 1998 as too few participants made enquiries for the programme to operate.

Towards the end of 1998 the Ministry of Education again directed Maktab SOAS to offer a Pre-Entry Programme at the beginning of 1999, this time stipulating that the Programme was to operate regardless of the number of students. Several questions about the Programme had to be broached.

Questions the programme generated. The directive to operate a Pre-Entry Form 6 Programme appeared simple and sensible but offered little definite information. Teachers could only estimate the number, interests, and abilities of the students. The date of the start was uncertain and the Programme was to end when the O-Level examination results were published, a date that could only be estimated. Teachers considered absence of information for these factors as limiting to their planning and preparation.

The most crucial factor for the teachers in preparation for the Pre-Entry Programme concerned the content. However, they considered the omission of specific information here to be a degree of freedom rather than an impediment. With external examination boards prescribing the syllabi used within Brunei secondary schools it was unusual for teachers in the education system to be afforded the opportunity to provide professional input regarding the content or direction of the courses they operated. In the absence of definite directives, the Principal of Maktab SOAS consigned the content of the Pre-Entry Form 6 Programme to the teaching staff involved. Teachers considered there to be two possible approaches. The first was to present standard lessons using examination subject content, which was the expected and easier path for teachers. The alternative was to address the Programme as a separate entity in which the activities formed a self-contained course of study. Both approaches provided their own set of logistical questions.

The expected and simplest method for teachers to conduct the Pre-Entry Form 6 Programme was to offer the A-Level subjects that were available at the school. This Programme had to function within the existing timetable of the remainder of the school and it would not have been possible for all students to receive exposure to all Form 6 subjects taught at Maktab SOAS. There were many

unknowns. Which subjects should be offered to which students? Should students have open choice regarding subject choices? How many students would opt for which subjects? Art as an A-Level examination subject was to be offered to students as an optional extra outside normal school hours. How would this teacher provide all students with experiences that may incite interest in her subject if she had no allocated time within the normal timetable?

Individual subject teachers would have determined the content of a traditional programme: What content should be presented to the students? Should a teacher revise content from the Form 5 syllabus and risk disaffecting the more able students? Or should the participants be presented with new content from the Form 6 Syllabus? Teachers could not plan for continuity of content beyond the time period of the Programme as it was not known to which A-Level school the Ministry of Education would direct successful students. Consequently, the same content would have to be repeated later in the year with regular Form 6 classes.

Uncertainties within the directive from the Ministry of Education and the above questions restricted teachers' enthusiasm for the traditional approach. Their conclusion was that conducting the Pre-Entry Form 6 Programme using the expected traditional content and modes of instruction would have contained minimal educational merit for the students and provided limited interest for staff. Consequently an alternative was sought.

The Alternative Form 6 Pre-Entry Programme

Rationale for the Maktab SOAS Environmental Research Project (SERP)

Teachers assigned to undertake the Pre-Entry Form 6 Programme expressed their preference for establishing an alternative set of activities that they believed to be more educationally worthwhile than a limited traditional approach. The Principal

of Maktab SOAS supported the teachers in considering the time period as an entity separate from solely examination-focused content. Rather than following traditional classroom lessons, the teachers preferred to provide students with various experiences to enhance, rather than duplicate or replace, their Form 6 study. The removal of boundaries and limitations laid open the quintessential question "What to do?"

The Form 6 Pre-Entry Programme at Maktab SOAS

Teachers divided the Form 6 Pre-Entry Programme into two sections. The first consisted of various lectures and visits to local businesses, which were undertaken by the school Counselling Department and the teachers of commercial subjects; accounting, economics, and management of business. Such activities by Maktab SOAS and other schools were familiar to Ministry of Education officials and school administrators.

The second section formed the innovative element of the Pre-Entry Programme and is the centre of interest for this appendix. These activities developed an entity of their own within the Programme and became known as the SOAS Environmental Research Project, or SERP. The objective was to focus on a central theme as it related to the subjects of art, biology, chemistry, geography, mathematics, and physics.

Aims of SERP

There were five aims of SERP.

1. To develop skills in collecting, processing, analysing, and presenting data.
2. To strengthen basic skills needed for A-Level studies.
3. To enjoy a worthwhile learning activity.
4. To build up team skills such as leadership, cooperation, and motivation.

5. To become confident in handling new tasks in new situations, applying what was already known to make new discoveries.

Students visited a location near to the school to perform tasks and collect data for processing at school. The Project culminated in a display at the closing ceremony for the Form 6 Pre-Entry Programme.

Location of the Site for SERP

The location chosen for the environmental study was a river valley within 2 kilometres of the school and near the centre of the capital city, Bandar Seri Begawan. Access to the site required a 5-minute drive and a walk of approximately 10 minutes up the river. The river was enclosed by secondary jungle.

Bandar Seri Begawan has been subjected to considerable construction and development over the years, but the immediate area of interest for SERP had limited disturbance as it was relatively steep for construction purposes. Several years previously, construction began on a considerable subdivision that backed onto the river watershed. Roads, drainage and building foundations were established but construction was halted, the site abandoned and left to decay.

Participants in SERP

A total of twenty-two male students enrolled for the Pre-Entry Form 6 Programme at SOAS. Three students withdrew from the Programme before SERP activities began and attendance at SERP activities varied between fourteen and nineteen students.

Evaluation of SERP

SERP formed a style of educational enterprise not previously attempted in Brunei Darussalam and the teachers were unsure how students would react to the

activities. Educational evaluation and assessment in Brunei Darussalam focuses on the traditional silent examination format, this being familiar to, accepted by, and comfortable for, Ministry of Education officials, parents, and students, as well as many teachers. However, the SERP teachers considered such traditional assessment procedures to be inappropriate within the ethos of SERP. Concern among Ministry of Education officials over the absence of usual class seat work and expected tests was informally relayed to the teachers through the school administrators who nevertheless continued to support the teachers in their endeavour.

The unusual nature of the SERP activities provided anxiety for the teacher-organisers in the initial stages of SERP. Reactions of students and parents can be markedly strong towards persons or activities seen to transcend at-times undefined borders of acceptability. All the SERP teachers were foreigners from races, religions, and cultures other than those of the students, and they were aware that these differences can exacerbate variances in student-teacher perceptions. The Ministry officials' concerns provided extra cause for teachers to be tentative during the initial activities.

Students' perceptions. There was little indication prior to the first activity how students would perceive the unusual nature of the SERP activities. The success or failure of the Project was considered to rest on their interest and reactions to the various activities, particularly in regard to the time spent out of the school compound at the jungle study site. Teachers' early concerns revolved around the possibility that participants may react against efforts to provide environmental experiences that were outside their perceptions of what constitutes normality of school in Brunei Darussalam.

Teachers involved in SERP faced several difficulties in assessing the students' perceptions of the Project. They did not expect any form of feedback directly from students unless there were complaints of considerable severity by the students or their parents. The dominant form of assessment of students' interests in the activities would be through teachers' personal judgement based upon their subjective observations. Teachers were also aware of their lack of character knowledge for the majority of the individual students. Whilst a few were past students of Maktab SOAS, most students and staff were mutually new acquaintances. Traditional cultural reserve and deference towards authority figures were considered to increase the difficulty for teachers to establish students' perceptions of the various SERP activities.

The Pre-Entry Programme ran concurrently with the normal operation of the remainder of the school. Teachers involved in SERP were also required to teach their normal subject classes and this often required rotation of staff attending activities, reducing their appreciation of any single activity as a whole. When possible, staff members remained on site with the students for all of an activity. Since there was no guarantee that teachers would be present throughout even their own activity, a form of evaluation was needed that did not require their presence at the site.

Implementation of SPAID within SERP

The Students' Perceptions of an Activity Instrument and Display (SPAID) package was used to overcome the dearth of information on students' perceptions of various activities within SERP. The SPAID package was designed to obtain students' reactions to new activities that teachers attempt within their normal subject-based teaching praxis. Use in this situation proved a test of SPAID's versatility as it evaluated a series of activities out of the normal schooling context conducted by

different teachers with an unfamiliar and temporary group of students. However, a desirable feature of the survey is the ability to isolate individual categories or even individual items for consideration. This appendix considers teachers' interests in the five SPAID characteristics and the uses to which they put the information obtained through the accompanying computer graphing template.

The survey within the SPAID package required students to respond to items by comparing their reactions to the designated activity with what they considered to be usual for the class. The absence of homogeneity for what could have constituted usual schoolwork for participants when responding to items in the survey was recognised as a limiting factor. Students were pointed towards considering their expectations of the Pre-Form 6 Programme as they responded to items. As students became more familiar with the SERP activities their perceptions and expectations were likely to alter, and they were reminded each time to compare each particular activity in relation to their original expectations.

Students completed the Student Version of the survey following each field trip to the SERP study site. Over the period of the Project 13 students' responses were in the Bahasa Melayu version and 79 in the English version. Teachers accompanying SERP field trips were encouraged to complete the teacher version of the survey. The number of teachers with each of the five activities varied and the leader of each trip completed the teacher version with a further five other teachers also completing responses. I considered this to be a pleasing level of response from teachers who had many other different tasks to complete.

Time Delay

There was a dichotomy of need in the rate information was examined and acted upon. It was considered important to obtain indications of students' early

reactions to the SERP activities as rapidly as possible to determine whether significant redirection was required. By contrast, it was expected to be a full year before some of the individual activities would be repeated with a new group of pre-entry Form 6 students.

Honest Responses

Students were encouraged to respond honestly to the items in the survey and the anonymity of the SPAID was stressed. The limited and intermittent association between students and teachers prior to the SERP activities would have had minimal influence in relieving the traditional deference for authority figures. All teachers involved in SERP activities were foreigners who were cognisant of the linguistic and cultural differences between themselves and their students that could have inhibited the establishment of rapport. Anonymity was emphasised through combinations of requesting surveys being returned upside down, having a student collect the completed surveys, and shuffling papers in an obvious manner whilst talking to the groups of students at the conclusion of each activity.

SERP Activities

Students had engaged in five outdoor activities within the study area by the end of the Project. The remainder of this appendix evaluates the viability of the SPAID package to provide teachers with information that they consider useful to their assessment of events. The first example is the first SERP activity the students encountered, the second example is one of the subject-orientated activities, and the third use of SPAID provided summary information about students' perceptions to SERP that was used within the display at the closing of the Programme.

Orientation: The Crucial First Activity

The unique nature of SERP within the traditional education system of Brunei Darussalam presented exciting prospects for teachers involved in the conception and implementation of the Project. Coincident with this excitement was apprehension of the reception by students, parents, and Ministry of Education officials. Negative reactions from any of these groups could have had significant impact on the remaining activities, perhaps leading to a directive to revert to traditional schooling. Obtaining students' perceptions through the SPAID provided teachers with a means of pre-empting possible difficulties with SERP, as well as obtaining indications of possible improvements.

The Orientation activity comprised a jungle walk through the general area of SERP followed by some initiative tasks. The walk lasted about 2 hours and was designed to introduce students to the area surrounding the study site and the range of physical features that it contains. Initiative tasks were aimed at encouraging collaboration in completing tasks with minimal direction. Teams of three were required to build a fire without paper and use it to boil a can of water and cook a sausage. These simple tasks proved to be appropriate novel experiences as few of the nineteen students who took part in the Orientation activity had previously been in any form of jungle and only one admitted that he had previously lit a wood fire.

Survey categories of interest to the teacher. Two of the five characteristics from the SPAID were of primary interest to the teacher in charge of SERP who was also the leader of the Orientation activity. Enjoyment was seen as the highest priority. Early indications of strong negative students' reactions would have suggested the need to temporise the remaining SERP activities. The second priority was Communication. Whether students understood the instructions they were given

for the various aspects of the day's activity was considered crucial to their awareness of what was going on, and to have influenced their enjoyment.

The teacher considered the remaining three categories of Understand Content, Relevance, and Work Output as incidental. He anticipated that students would have had difficulty appreciating the role of particular tasks within the general scheme of SERP. For example, the orientation walk may have appeared simply to be a walk in the jungle to students at the time, however the knowledge obtained from their walk would prove useful in later activities. Consequently, the teacher expected information obtained from students' responses to categories other than Enjoyment and Communication to be of limited concern.

Results

Results from the Orientation activity provided the first indications of students' perceptions of SERP other than the teacher's own subjective estimations. His interest in results and the various graphical representations was limited to that of the summary graph for the five characteristics showing totals for the students and teacher, shown in Figure 12.

Enjoyment and communication. Initial interests for the teacher were whether the 19 students enjoyed the events of the morning and whether they thought they understood the instructions. His own perception was that the students had enjoyed themselves, however there have been instances in Brunei when a teacher's estimation of students' enjoyment has been inaccurate (Nannestad, 2000; Nannestad & Dobson, 1999). He was pleased to note his estimates of students' perceptions in the two categories of Enjoyment and Communication were only marginally lower than the average of students' responses.

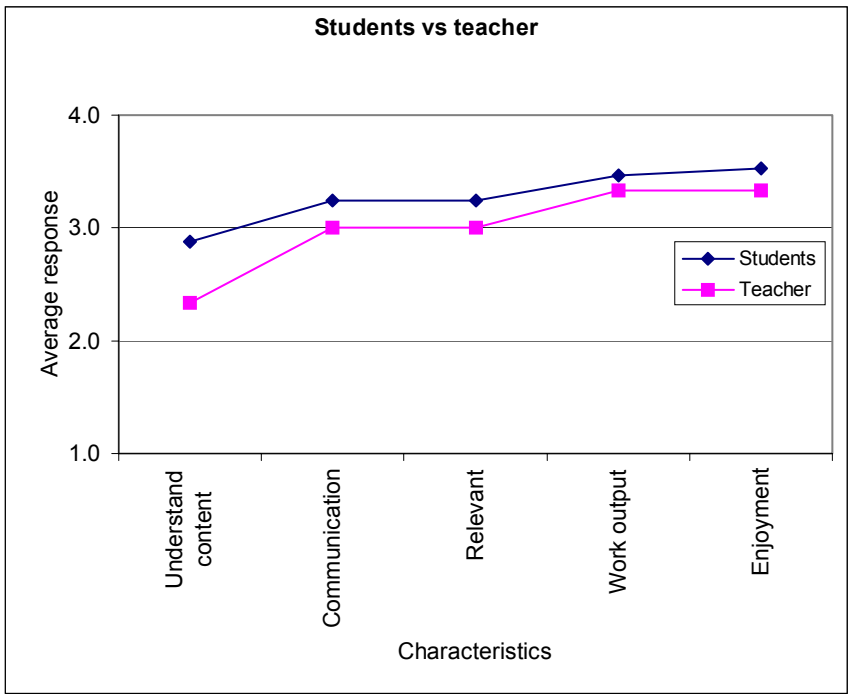

Figure 12. Summary of SPAID responses from the SERP Orientation activity.

Tentative beginning. The teacher's caution in assessing students' reactions during the first activity was illustrated by his responses for all categories being lower than the average responses of students. He considered this preferable to being overoptimistic and having seen Figure 12 decided he could be less conservative with his responses to future SERP activities. His conclusion was that the results provided vindication for his belief in the worth of the SERP activities. The timeliness of the feedback permitted him to engage in the second activity the following day with greater confidence and bolstered enthusiasm.

Open-Ended Comments

Table 10 lists students' comments in response to the open-ended stem at the end of the survey. It needs to be noted that the numbers assigned to students were arbitrary, i.e. the responses for Student 1 in the Orientation activity did not match with student 1 in the other SERP activities. Anonymity of students' responses' was

enhanced by the absence of any required identification that could link individuals to particular responses. Unfortunately, this also prevented comparing individual students' responses across the different SERP activities.

All students' comments were written in English, believed by the teacher to be a consequence of the teachers involved in the activity being foreigners with limited facility in Bahasa Melayu. 8 of the 16 comments indicated a desire to have spent more time engaged in the orientation or similar activity in some form (Students 1, 2, 4, 6, 8, 9, 17, and 18), with 3 responses specifically mentioning camping on the site (Students 1, 8, and 9). Two comments considered the walk too long and tough (Students 5 and 19), and four others would have preferred the provision of better transportation, equipment, and food by the teachers (Students 7, 10, 11, and 12). One student desired more information (Student 15) and one other mentioned the inclusion of girls in the Programme (Student 16).

Table 10

SERP Orientation Activity Students' Written Responses to the Open-Ended Item

Students	*I feel the activity would have been better if…*
1	Would be better if we camped in there.
2	Should be on every week.
4	We spend more time in the jungle with adventure exercises (jungle tracking).
5	The journey was not so long.
6	We spend more time.
7	There is better transportation.
8	We camped in the site.
9	We can have the chance to camp on the project site.

(table continues)

Students	*I feel the activity would have been better if…*
10	The teachers provide us with food supply and better transportation.
11	We are fully equipped.
12	We have enough equipments.
15	It was more coordinated and students were more informed.
16	Girls were included.
17	We spent the whole day doing it (from 8:00 – 4:00 p.m.).
18	Spent more time here.
19	The walk through the research centre was not as tough or far.

Teacher's reactions to students' comments. The teacher's reading of the open-ended responses took about 2 minutes and he considered them in total to show further support in favour of the activity. Camping expeditions were not known within the Brunei school system or general society other than under the control of the Scout or Army Cadet movements. Enthusiasm for extra curricular activities in SOAS College was growing to complement academic effort and the students' camping suggestions were to be considered seriously by the teacher should the Project be repeated the following year.

Comments relating to the walk being too long were not viewed as negative reactions to the activity itself, with the teacher considering them more a result of students' lack of exposure to jungle walking and similar outdoor activities. Provision of minimal equipment was intended to promote initiative and teamwork, and the suggestions for better equipment, food, and transportation were considered reactions from young males with limited exposure to self-sufficiency. The requirement for flexibility in the organisation of SERP precluded the use of transport from external sources. The school did not possess forms of group transport, such as minibuses, so the teachers had donated their own vehicles and petrol for the activity and they too

preferred better transportation. The exclusion of females in the Pre-Entry Programme was a Ministry of Education decision over which the teachers had no influence.

Teacher's Conclusions from SPAID Data

The organising teacher's conclusion from the SPAID information was that the orientation activity was appropriate for the students and should be used again if the SERP were to operate the following year. He would improve the information received by the students. SERP was an experimental project and contained many uncertainties in the planning stages, with requirements from different administrations altering several times. Although the teacher considered the information passed to students had been adequate under the given circumstances, he would change the presentation of that information should the Project be repeated.

The survey provided the teacher with timely students' endorsement for the style of activities within SERP. This alleviated his concern for potential repercussions from any disaffected student or parent, and encouraged him in his organisation of the remainder of the SERP Project.

A Subject Activity: Biology Bacteria Culture

The following section outlines the role of the SPAID in assisting a biology teacher to assess the efficacy of her activity within the SERP. This use was closer to the original intent of SPAID than the other two examples in this appendix. The teacher's interpretations of data promoted minor improvements that were considered significant in improving the efficacy of the activity. The subject of the biology activity was the growing of bacteria culture from samples obtained at intervals along the river. Growing bacteria would have been a topic new to Form 6 biology students as it is within the A-Level course but not the O-Level syllabus.

Concerns of the Teacher

Prior to undertaking the Bacteria Culture activity the teacher had two concerns about her activity. First, the results from the activity were expected to be less spectacular than she desired. Orders for new materials had been placed but the materials had not been received, so a stale nutrient remnant of earlier years, when the school had offered A-Level biology, was used. The lessened reactions were expected to reduce the impact of the activity on students.

The second concern came from the teacher having had little contact with the students prior to the activity. She expected to have difficulty assessing their reactions to the Bacteria Culture activity and the SPAID package was seen as a valuable means of reducing this limitation.

Results

Teacher's interest. The teacher's interest in students' responses to the survey prior to undertaking the activity centred first on Communication and then Enjoyment, as did the Orientation teacher in the previous example. The remaining characteristics of Understand Content, Relevancy, and Work Output were viewed as concomitant but of secondary significance.

Communication and Enjoyment. The biology teacher's initial interest in the SPAID graphs was in the summary of responses for the Communication and Enjoyment characteristics (Figure 13). She was pleasantly surprised by her close estimation of the students' responses to Communication items, which quickly allayed her initial concerns and her attention turned to exploring other characteristics. This rapidity of changing interest highlighted the rate and flexibility at which teachers operate in their praxis. Students' reactions to Enjoyment were more positive than the teacher's estimates and this pleased her. She offered as a possible explanation that

the students were unaware of the difference between results obtainable through using fresh nutrients as opposed to those that were dated and stale. Consequently, students were able to enjoy the activity to a level higher than the teacher thought they would or should.

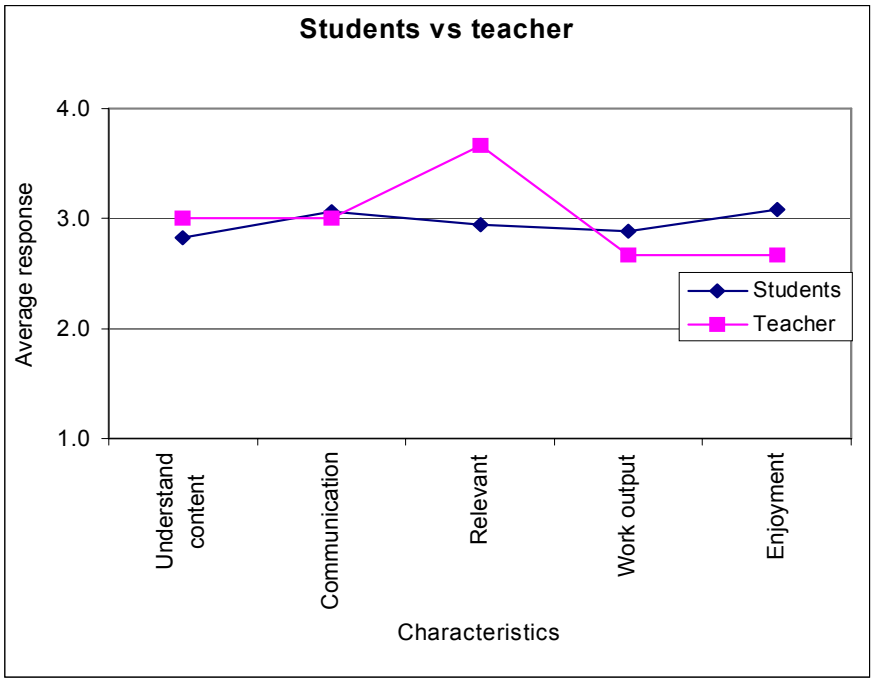

Figure 13. Summary of SPAID responses from the SERP Bacteria Culture activity.

Relevance. The most significant difference between the perceptions of the students and the teacher occurred in the Relevancy category. This was a surprise to her, as she thought the activity would have been of interest to the students and that it contained considerable environmental application. She also thought she had stressed the applicability of the content to the A-Level syllabus. The activity had been chosen to whet students' interest in Form 6 biology and the teacher believed it to be ideally suited for use with the Project. The disparity between the teacher's responses and those of the students prompted her to investigate this result further.

From considering the graphs of responses to individual Relevant items (Figure 14), the teacher considered that the students thought the activity was useful generally but were slightly less convinced that it would help in the subject biology. Students were also less convinced that it would be useful for tests. Further enquiries established that only three of the seventeen students engaged in the Bacteria Culture activity were intending to enrol for biology in Form 6. Such a low level of interest in biology had not been expected during the SERP planning stages and would have influenced the depth of content the teacher included in her activity, and she appreciated the difference between students' and her responses to the Relevance characteristics.

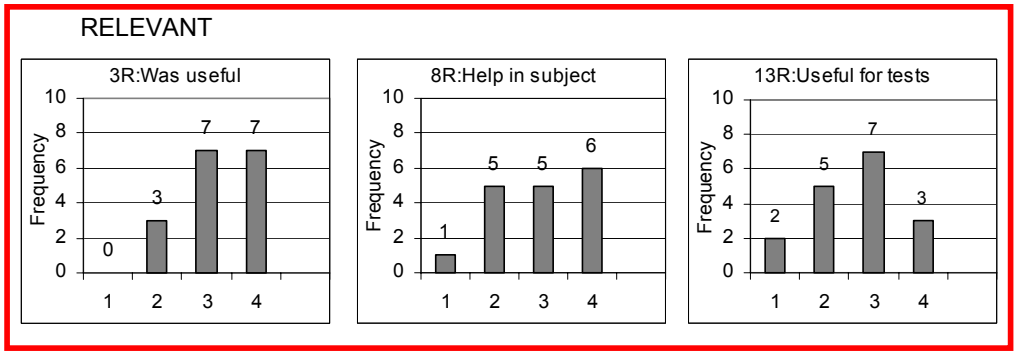

Figure 14. Bacteria Culture activity students' responses to the Relevant characteristic items.

Open-Ended Students' Comments

Seven out of the 17 students who undertook the Bacteria Culture activity provided written comments in response to the open-ended item at the end of the survey (Table 11). Two comments indicated a desire to have spent more time engaged in the activity (Students 4 and 9) and one mentioned camping on the site (Student 2). This comment was not taken as a desire to spend more time doing the biological activity, but for as a general endorsement for the outdoor nature of the

SERP activities. Two comments referred to desiring better equipment (Students 6 and 12), one comment noted the weather (Student 13), and the other comment was "We were given more customer service and also more meal" (Student 3).

Table 11

SERP Bacteria Culture Activity Students' Written Responses to the Open-Ended Item

Teacher	*I feel the activity would have been better if…*
	We had the right equipment in sufficient number.
Students	*I feel the activity would have been better if…*
2	We can have the chance to camp.
3	We were given more customer service and also more meal.
4	We had more time doing it.
6	It was more organised and equipment was more durable.
9	We spent more time.
12	There are more instrument available to do the project.
13	The activity is done the day before the stream was disturbed by such a heavy rain.

Teacher's reactions to students' comments. The teacher considered none of the written students' comments to be negative towards her Bacteria Culture activity. She appreciated the desire for more time at the site. Other school events had interrupted the time period for the activity and students' reactions mirrored her thoughts. Lack of equipment was an expected difficulty and the weather comment was noted, though she believed neither was within her control. The response referring to customer service and meals was not considered seriously and was suspected to reflect a visit conducted previously in the Pre-Entry Form 6 Programme to a local hotel.

Changes to the Bacteria Activity

The major decision for all SERP teachers was whether to retain the same activities should the Project be repeated the following year. The biology teacher considered the Bacteria Culture activity to be highly appropriate and apposite to the aims and intentions of SERP. There were no indications from students to cause her to consider developing a different activity. Her attention moved to identifying possible changes within the activity.

Initial concerns over communication and enjoyment were no longer issues for the biology teacher following her considering the SPAID results. Attention turned to the previously lesser-considered Relevance category which provided impetus for changes to the activity. The teacher's major change was to conduct the activity in more general terms, reducing the emphasis on specific A-Level biology syllabus content. She would now consider all SERP students as non-biology and generalise concepts in broad terms with limited reference to the technical specifics required by the examination syllabus. Emphasis would focus on consequences and potential flow-on effects of various ecological scenarios. She expected this to increase students' perceptions of relevance and perhaps align even closer to the aims of the Project.

A minor change was initiated from the teacher's consideration of the students' responses to the Enjoyment characteristic. She decided to include a comparison of the results obtained by using the currently-held nutrient that was relatively inactive, against results that may be obtained from using nutrient that is fresh.

The teacher believed that it would not be possible to obtain more time at the study site should the SERP be repeated the next year. Consequently, the students'

open-ended comments referring to spending more time at the site led her to consider methods to improve the use of the allocated time. Reviews of the written instructions, the division and allocation of tasks, and the imposition of time limitations for the completion of these tasks were considered means to achieve this. The effectiveness of these changes would be assessed the next time the Project operates.

Teacher's Conclusions from SPAID Data

A major benefit of the SPAID for the biology teacher was the provision of a timely structure through which she was able to reflect upon her Bacteria Culture activity. She was well aware that such reviews are important but seldom manages these in the rush of daily teaching. Although teachers know they should reflect upon class activities, making the time to do so is difficult. On occasions when the time is made, teachers are reliant upon their own incidental and subjective observations that readily dull with delay. The teacher considered that without the impetus from the graphical displays of the SPAID package, she would have become embroiled in the daily activities of her current classes and delayed reconsideration of her biology activity. She expected that 8 months or so would have lapsed before serious discussion of repeating the Pre-Entry Form 6 Programme may next arise, and the importance of many issues and her concerns would have greatly abated.

Through completing the teacher version of the survey immediately after the activity the teacher began considering potential alterations to match issues that were of significance to her at the time, but even over this short interval they had begun to fade in importance. The immediacy and pressures of other classes and teaching activities were already overshadowing her reflections of the Bacteria Culture activity.

Change in perspective. The biology teacher believed that her attempt to consider the activity from the perspective of the students was a highly worthwhile

experience. She found it very difficult to do so, considering it to be important for teachers, but also a process that is too readily omitted.

Without recording her own responses and comparing them with those of the students, the teacher believed much of the potential to improve the Bacteria Culture activity would have been lost in the daily rush of teaching. The survey and results made her stop and reconsider the activity when otherwise she would not have made the time to do so.

SPAID use in the Summary of SERP Activities

The third and final illustration of a teacher using the SPAID in his assessment of the SERP issued from the poster display that accompanied the official ceremony to close the Pre-Entry Form 6 Programme. As well as students' displays of work, the teacher in charge of SERP presented a summary of the students' perceptions obtained via the SPAID package. All students' responses to the survey during the Project were combined to generate graphical displays. This was considered to provide a quantifiable and succinct summary of students' reactions to the SERP activities. Interest of the graphs was limited to the single graph that summarised students' responses to the five categories, which is shown in Figure 15.

The distinction between the response options *more than usual,* that scored 3, and *less than usual,* that scored 2, provided the teacher with a ready indicator as to whether the Project had been worthwhile. Quantification of the Likert-type responses led him to placing a line of demarcation at 2.5. Responses over 2.5 were regarded to suggest students were generally in favour of the Project and below 2.5 suggested the Project required rethinking. While there may be arguments against such a simplistic approach, it is well to recall that the teacher was looking for a quick, simple, and clear indication of students' perceptions. Also, clearly defined numerical boundaries

are the norm within the educational environment of Brunei Darussalam, with teachers, students, and any other readers of the poster session being familiar and comfortable with such lines of demarcation.

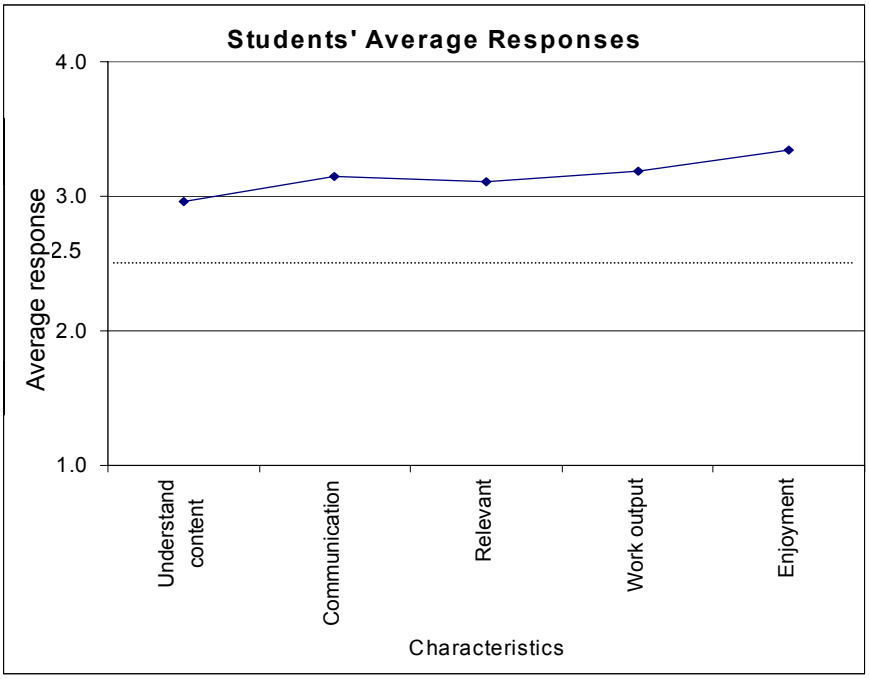

Figure 15. Summary of students' SPAID responses for all the SERP activities.

Two central paragraphs concerning students' reactions to SERP contained the quintessence of this part of the display and are quoted below. They illustrate the succinct summaries that the teachers sought when assessing their activities.

> Students' average responses indicate the students considered all aspects of SERP as measured by the survey more favourably than normal schoolwork. This is made more surprising considering the heavy rain that fell during the Project, making the fieldwork more difficult for students.
>
> The graphical displays suggest that students participating in the SOAS

> Environmental Research Project understood the instructions and the relevance of the activities more than their normal school work. Most noticeable is that the participants achieved these improved educational outcomes with much higher levels of enjoyment. It is possible to enjoy learning and these students did. (Alpe, 1999)

Teacher's Conclusions from SPAID Data

The summary of students' responses to the SPAID survey and their comparison against the 2.5 demarcation line appeared sufficient to satisfy the teacher that his belief in the worth of SERP had been ratified. He was selective in the characteristics of interest; Communication, Relevance, and Enjoyment. The other characteristics, Understand Content and Work Output, received indirect and subsidiary mention.

Conclusion

The SPAID package proved to be a viable means by which teachers could obtain reactions to activities from a group of students relatively unknown to them. Teachers involved in organising these SERP activities believed the information from the SPAID package to be an asset in their evaluation of the Project. They appreciated the provision of a structure for a timely reconsideration of activities. Changes in the activities were not necessary for teachers to believe they benefited from considering students' responses to the survey. Favourable students' responses together with encouraging open-ended comments provided teachers with positive reinforcement towards activities and ratified their preference for SERP over a traditional approach to the Pre-Entry Form 6 Programme.

Enjoyment and Communication were central to teachers' interest while Relevance proved of interest at times. The more examination-orientated considerations in the survey, Understand Content, Work Output, and some aspects of Relevance, received cursory viewing and teachers were content not to consider them further.

Changes were initiated when teachers considered there were significant differences between their estimates of students' responses and those that students supplied. Students did not suggest possible changes to the activities directly. Rather, their responses proved to be catalytic in indicating directions for teachers to investigate further.

Appendix D has shown the use of the SPAID in a situation unusual for teachers and students in Brunei and has demonstrated the versatility of SPAID. Teachers were provided with timely information of students' perceptions that helped them assess and improve the efficacy of the activities. This was particularly important due to the paucity of teachers' knowledge of the students and their belief that the Project formed a worthwhile venture.

Note:

For copyright reasons **Appendix E** containing the following newspaper article has not been reproduced:

'No' to spoon feeding. (1998, March 18). *Borneo Bulletin,* p.3.

Appendix F Classes for which SPAID Results Have Been Obtained

Activity	Class	Teacher	Subject	*n*	Class time (minutes)	Processing time (minutes)	Number (%) of students using version	
							Bahasa Melayu	English
1	Form 2 Form 2	T	Science	60	15 15	25	21(35.0%)	39(65.0%)
2	Form 6	U	Geography	8	Not recorded		1(12.5%)	7(87.5%)
Appendix C Activity								
3a	Form 4	V	Maths trigonometry	19	10	10	12(63.2%)	7(36.8%)
3b	Form 4	V	Maths trigonometry	21	7	10	17(81.0%)	4(19,0%)
			Trigonometry summary				29(72.5%)	11(27.5)
4	Form 6	V	Maths statistics	18	10	15	1(5.6%)	17(94,4%)
5	Form 6	V	Maths stats project	18	8	12	1(7.1%)	13(92.9%)
6	Form 6	V	Maths examinations	13	8	12	1(7.7%)	12(92.3%)
7	4A2	V	Maths isometric paper	23	12	15	17(73.9%)	6(26.1%)
8	Form 6	V	Logic puzzles	20	10	10	0(0%)	20(100%)
Appendix D Activities								
9a	Form 6	U	SERP Orientation	19	12	15	3(15.8%)	16(84.2%)
9b	Form 6	U	SERP River exercise	19	10	12	4(21.1%)	15(78.9%)
9c	Form 6	W	SERP Biology	14	4	10	4(28.6%)	10(71.4%)
9d	Form 6	W	SERP Bacteria	17	4	10	0(0%)	17(100%)
9e	Form 6	X	SERP River trig	15	5	10	0(0%)	15(100%)
9a-e			SERP activities summary				13(14.1%)	79(85.9%)
10	Form 6	U	Geo-Hydrology	8	6	5	2(25%)	6(75%)
11	4A1	T	Science crossword	37	10	15	19(51.4%)	18(48.6%)
12	4A2	T	Science cards	24	10	15	8(33.3%)	16(66.7%)
13	Form 6	V	Maths quincunx	16	8	12	1(6.3%)	15(93.8%)
14	U6ScB	V	Examination revision	14	5	5	0(0%)	14(100%)
			Total	383			112(29.6%)	267(70.4%)
			AVERAGE	19.2	8.9	11.5		

Appendix F1 Summary of Activity 1 with SPAID Responses

Background

The teacher had engaged his two Form 2 Science classes in several activities to provide variation and interest to the forms of learning that the students were using to gain recall of basic concepts and definitions. Some of the activities were given as non-traditional tests, and students were required to write out the answers to incorrectly answered items a number of times. The intention was for the students to correct their learning, which was a standard approach employed in the school.

The students' marks in these and other tests were not as high as the teacher had expected, and students did not appear to be as enthusiastic about the different activities as he thought they would be. Consequently, the teacher wanted some indication of students' perceptions of the activities, other than his subjective impressions.

Responses

The students' response sheets of the two classes were unfortunately mixed and the gender of each student was not recorded on all response sheets. As a consequence, the Survey form for students was amended to include an indication of male/female.

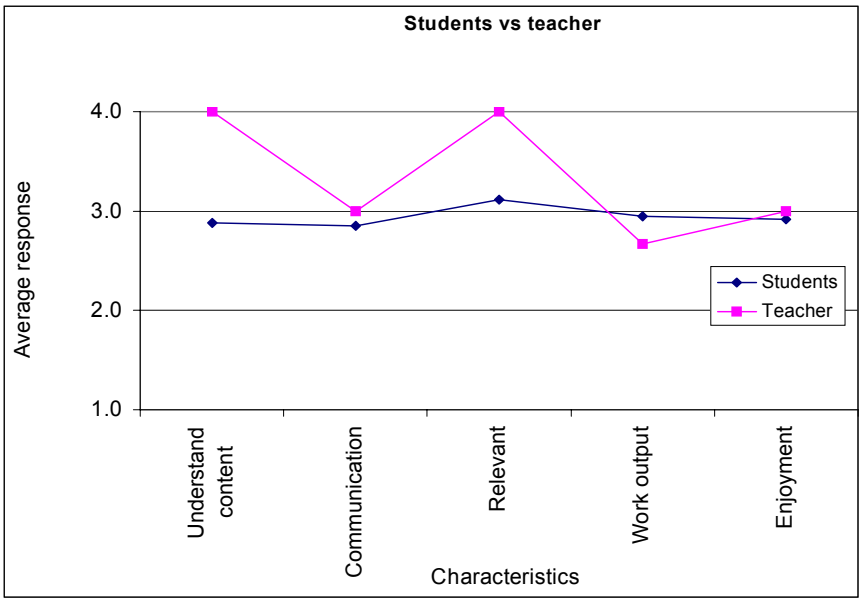

Figure 16. Summary of SPAID responses from Activity 1.

Table 12

Students' Written Responses to the Open-Ended Item for Activity 1

Students	*I feel the activity we did would have been better if…*
1	No punishment.
4	Do punishment for those who are lazy.
7	There is more punishment if the work done is wrong.
8	The teacher would give instructions slowly and clearly.
16	When the punishment not given too much because this is waste time to study our lesson.
17	We done it lasting.
18	There is no more crossword tests.
19	The punishment would not given-out too much because its disturbed our studied at home.
21	Do not give us more punishment because it wasting out time!!!! Babe.
22	Punishment wasting many time.
23	The teacher gave our any types of activities.
24	Decrease it and give us more note.
25	We do it carefully.
26	We worked hard and tried to do best for owns.
27	We done the work carefully.
28	Decrease it and give us more notes.
29	We don't have to do lines.
30	Decrease the test and give us more experiment notes and going somewhere for the experiment.
31	I try work hardly to get succesful in activity and make sure to improved the activity too.
32	Some student take care about what the teacher teaching and I hope a teacher give any activity to get better explain and to get better succesful to student.

(table continues)

Students	*I feel the activity we did would have been better if…*
33	When we do not to do the work where is the wasting time for example:- too much punishment.
36	This survey we have everyday. I like it very much.
37	The Activity. I have more meaning and instructions that we could understand. And also don't give as any punishment.
38	The teacher explain in the right step.
39	The activiti can be given me more useful and enjoyed.
40	There is no test for us.
41	We continue to study hard and the teacher must get the note for we reading.
42	There is more given from the teacher because it is very useful.
43	We do a lot of work. (No comen!).
44	There give more useful.
45	The subject teacher give some more work than usual.
46	We understand the meanings of the words that is seldom to be hear/know.
47	This activity have more Important things which have simple english.
48	The information is more!
49	We receive more information about it!
50	If the teacher don't give lot's of work/punishment to do.
51	If we don't have to do the test punishment.
52	We have more discussion our lessons with friends or teachers.
53	The activity does not have punishment.
54	There is no punishment to do.

Teacher's Reactions

The teacher was initially pleased that there were no markedly negative reactions to the activities. However, he was disappointed that students did not consider the activities were helping them to understand the content to the degree that he considered they should.

"Punishment" was a far greater issue with the students than the teacher had considered it would be. The system of having students repeat work or copy out

concepts that have been incorrectly answered in tests is a standard method employed in Brunei Darussalam schools and he did not expect the strength of students' negative reactions. The number of open-ended responses that related to this indicated a need evaluate the process.

Consequences

The teacher reviewed his expectations of students who failed to complete the tasks to a satisfactory level. Alternative combinations of reward and punishment were to be explored.

A number of the students asked for more notes (Students 24, 28, 30, 41). The teacher was reluctant to comply as he considered they had sufficient. He feared many students were not learning the information already given and little point was seen in providing them with more. This was seen as a possible means of these students distracting attention away from their learning and onto the teacher. Finding a means to have students realise their role in the classroom teaching and learning was not considered to be simple, though altering the punishment aspect may be a beginning.

One positive aspect noted by the teacher was the absence of comments against the activities themselves. While students did not like the tests (Students 18, 30, 40), negative comments were mostly directed against the consequences of low performance, not the requirement to complete the activities.

Appendix F2 Summary of Activity 2 with SPAID Responses

Background

Form 6 Geography had been newly introduced into the school and the teacher was concerned that the students would benefit from their experiences. He wanted to include a number of field trips into the surrounding areas to view the landscapes from a geographical perspective, and to relate what they had seen for many years to the content they were required to know for examinations. Field trips are not common for students of geography and this teacher was interested in the efficacy of his efforts.

The teacher was pleased that the fieldtrip was completed, and in an effort to improve the benefit for students, he was interested in obtaining an insight into their perspectives of the venture. The group of eight Form 6 geography students completed the SPAID survey following one of the earliest fieldtrip endeavours.

Responses

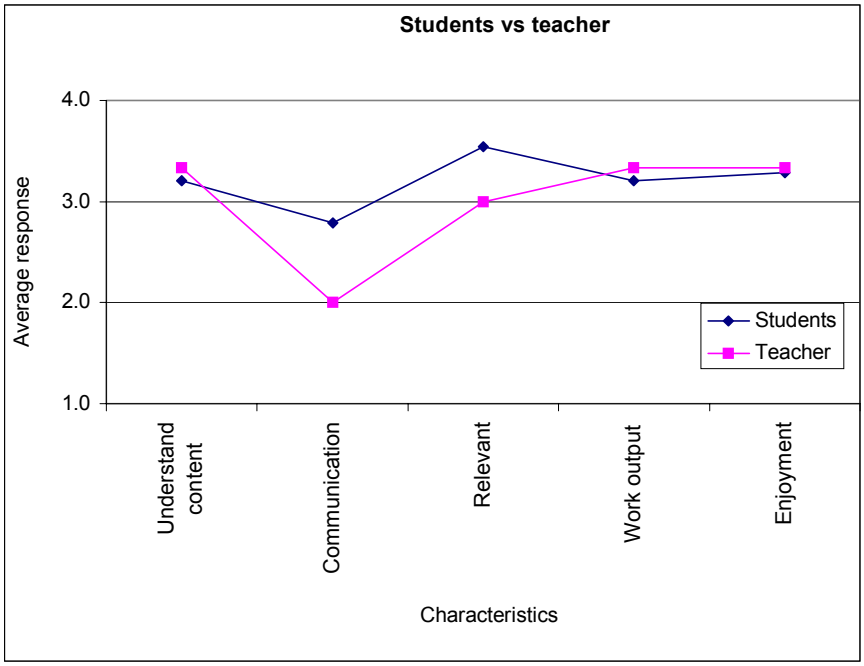

Figure 17. Summary of SPAID responses from Activity 2.

Table 13

Students' Written Responses to the Open-Ended Item for Activity 2

Teacher	*I feel the activity would have been better if…*
	Less activities, format of handout presented with stepwise explanations of tasks.
Students	*I feel the activity would have been better if…*
1	It was not so hot and tiring.
3	I'm being more committed.
5	We didn't have to punish ourselves and getting bruishes and scatches and experiencing such a painful and tiring ordeal.
7	Its not trying.
8	We have more activities to do.

Teacher's reactions

The teacher was pleased that there were no strong negative reactions to the concept of fieldtrips in which the students got hot, tired, and muddy. He was reminded that this type of excursion was new to the students, and the need for clear communication. The situation may have been aggravated by his expecting to complete too many activities in the allotted time.

Consequences

The next time he attempts a field trip the teacher will limit the number of tasks he expects students to complete. He will make an extra effort to provide a worksheet that replicates much of the information he expected them to know from work previously completed in class, and to make the instructions as clear and simple as possible.

Appendix F3 Summary of Activity 3 with SPAID Responses

Activities 3a and 3b are the subject of Appendix C. A graph of students' responses and their written open-ended comments are included here for completeness.

Activity 3a

Responses

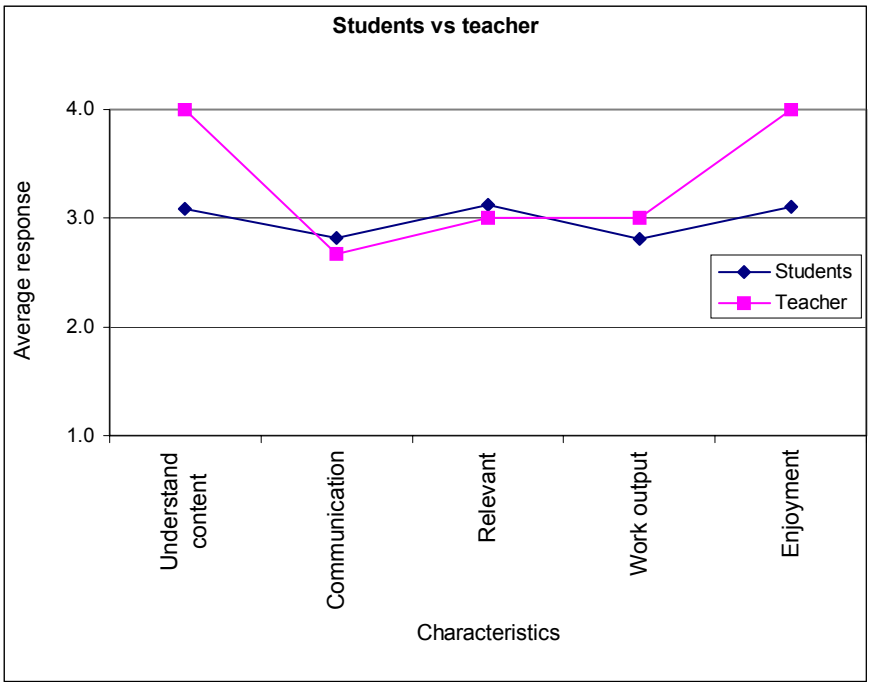

Figure 18. Summary of SPAID responses from Activity 3a.

Table 14

Students' Written Responses to the Open-Ended Item for Activity 3a

Teacher	*I feel the activity we did would have been better if…*
	I used markers to indicate the origins of measurements. Students had difficulty understanding my verbal locations, such as *base of the wall*, *directly below*.
Students	***I feel the activity we did would have been better if…***
1	(Translated) more practical than lecture.
2	(Translated) being done (carried) all the time.
3	(Translated) to be including in all our studies but could be time consuming.
4	(Translated) more of this type of activity to be organised.
5	(Translated) did it more seriously.
6	(Translated) being repeated all the time.
7	(Translated) teacher is able to supervise and explain with better clarity.
8	(Translated) often repeated.
10	(Translated) I do it more seriously.
11	(Translated) it is being done outside the school compound.
12	(Translated) not too serious
13	Doing a lot of practise so, we can have the experience and get well in exam.
14	It done once more by practise.
16	Me understand.
17	They do not frequently.
18	The teacher scolded us strictly enough so we can concentrate it.
19	We are going to Mumong – because at there I can do better and make me more active in my subject.

Activity 3b

Responses

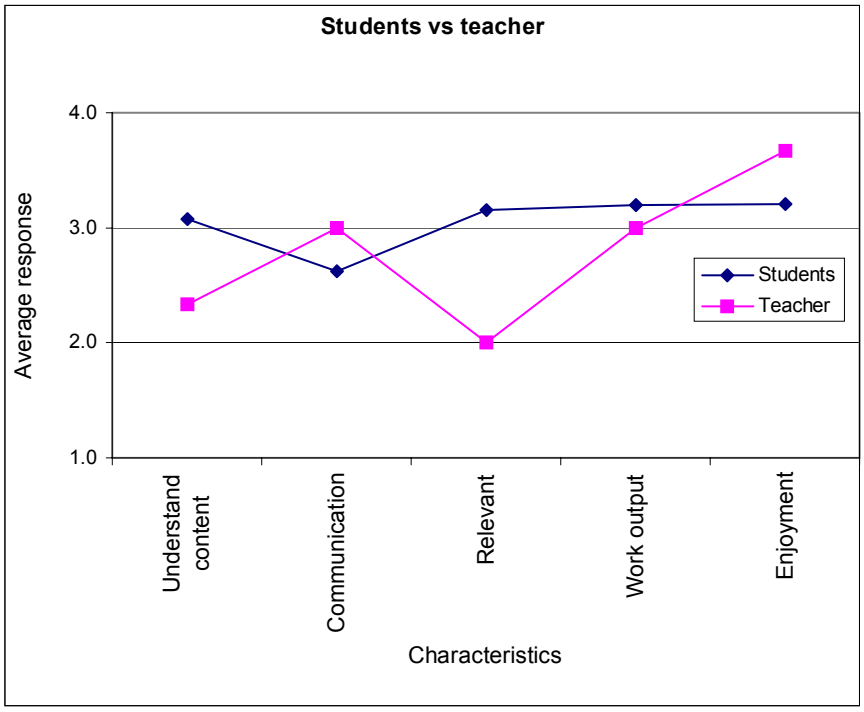

Figure 19. Summary of SPAID responses from Activity 3b.

Table 15

Students' Written Responses to the Open-Ended Item for Activity 3b

Teacher	*I feel the activity we did would have been better if...*
	One step at a time Plenty of demonstrating This is a "difficult" and noisy class doing a syllabus for which they are not suited. BUT when they were presented with the survey, every one was serious, silent and diligent at completing the form – very reassuring.
Students	*I feel the activity we did would have been better if...*
1	We listen what the teacher say and must consentred.

(table continues)

Students	*I feel the activity we did would have been better if…*
2	We go to the grandstand to do the work/ going to a field doing a project.
3	We do it every week.
4	The teacher explain step by step because sometimes student didn't understand what the main point the teacher said.
5	(Translated) I understand this activity
6	(Translated) it is taught slowly
7	(Translated) I try to concentrate
8	(Translated) I do work which is beneficial
10	(Translated) the activity keeps going
11	(Translated) it is being taught slowly
12	(Translated) we study seriously
13	(Translated) do it well
14	(Translated) to be continued for as long as possible and that students who come after us can also do likewise.
16	(Translated) we always study
19	(Translated) study together
20	(Translated) teacher will explain more
21	(Translated) if students do not make too much noise, if all can understand what is being taught, if noisy, how can we understand what is being taught.

Appendix F4 Summary of Activity 4 with SPAID Responses

Background

Eighteen students from my From 6 mathematics class were taken through the steps of an example of a statistical project. The intention was that they could parallel the process using data of their choosing that they gather. After the activity I considered that the students had not gained the benefit I had intended.

Responses

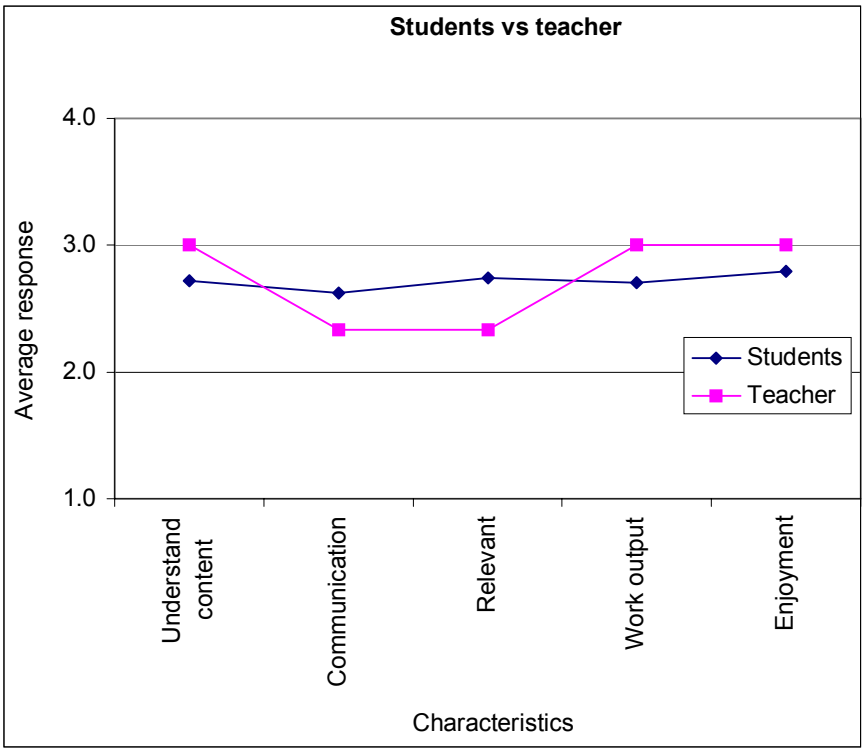

Figure 20. Summary of SPAID responses from Activity 4.

Table 16

Students' Written Responses to the Open-Ended Item for Activity 4

Students	*I feel the activity would have been better if…*
1	We did something that a bit more interesting stuff and do it in group style.
2	We practise a lot on this.
4	We do it by group and some more understand explanation would help tell joke sometimes so we can have a good time.
5	We did it in groups, so we could understand how to do the work.
7	The teacher can explain in better or other way.
8	It would be a more difficult one so that it would be much easier when doing it in the future.
11	Improve the teaching.
12	We work in groups.
13	We did it using our own idea individually.
16	We make it more interested.
17	We study in groups.
18	The teacher that is teaching is able to explain it better.

Teacher's Reactions

Students' responses suggested some were confused between the tasks that acted as an introduction, giving students experience at the required skills, and the tasks that were to follow, in which they chose their own topic, worked in groups, and used the practised skills. This may result from a combination of my communication of the requirements and their not realising the difficulties they may encounter.

This activity was undertaken to help students understand the content and to give this content some relevance, so the relatively low average responses to the items in the characteristics Understand Content and Relevant was a concern. Although there was some comfort in my close estimation of the students' responses, what I desired was a means for students to realise the benefit of practical activities in statistics. The unusual nature of undertaking practical activities may have been a barrier to students' appreciation, and any benefit may not become apparent until they sit examinations.

I suspect I attempted to achieve too much in a single session, especially given the students' limited exposure to practical activities in mathematics.

Consequences

I will attempt to achieve less in future sessions involving practical activities. The early introduction to activities may require more demonstration and less student involvement. This is counter to the intention of students being actively involved, but the jump for them appears to be more difficult than expected. Hopefully students will gradually appreciate the relevance of the content as they relate it to different tasks.

The several comments referring to preference for working in groups was encouraging, as this was the intention for the following activity. Whether this method of operating is beneficial may be a separate topic.

Appendix F5 Summary of Activity 5 with SPAID Responses

Background

This activity followed Activity 4. Consequential to the responses gathered in Activity 4, the tasks that students were to complete were limited to obtaining statistical values, rather than interpretation of those values.

Students in groups, consisting of two or three students per group, were to replicate the processes that they had worked through the previous session, this time using data of their own choosing. There were several comments in favour of working in groups within the open-ended responses following Activity 4, and I was interested to see how students reacted to doing so.

After the class had completed the activity I had the feeling that students had gained little from the experience, a situation similar to Activity 4.

Responses

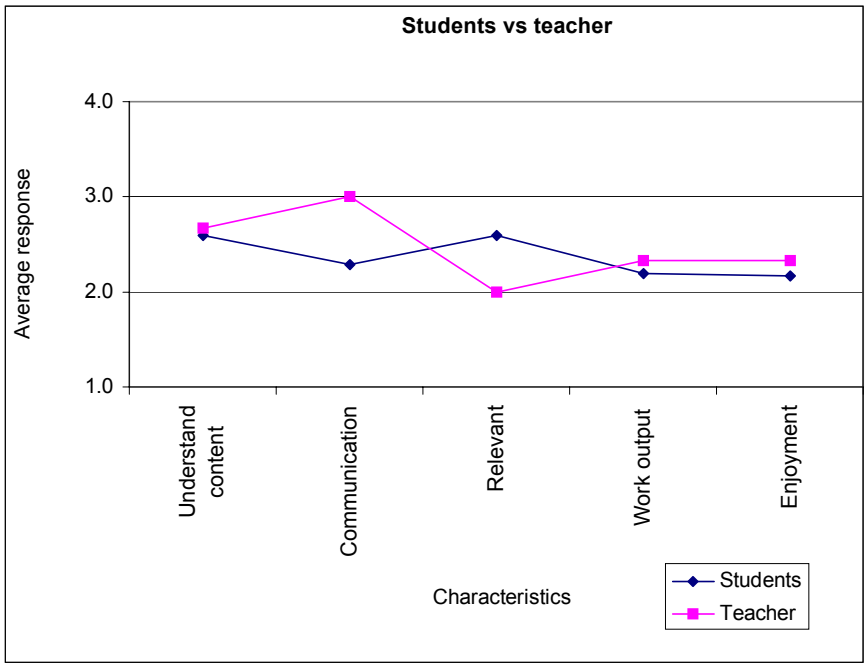

Figure 21. Summary of SPAID responses from Activity 5.

Table 17

Students' Written Responses to the Open-Ended Item for Activity 5

Teacher	*I feel the activity would have been better if…*
	The students took a while to begin work in groups. They seem keen to be in groups, but I am uncertain how much mathematics they learn from the method.
Students	***I feel the activity would have been better if…***
1	The teacher can explain the topic more in detail to help me doing the activity.
4	We try the easy before it get hard.
5	We do it in a small group for e.g. group of 3.
6	I know what to do in this activity and how.
7	It a more simply.
8	The teacher gave more instructions and helped his students to give some ideas.
9	We had more information about the activity.
12	We do it in group where each of the members deciding what to do for the groups.
13	I pay a lot of attention (who knows):→ what I went wrong.
14	I know how to do it and I'm not lazy.

Teacher's Reactions

Students took a while to begin their work, and seemed to produce results very slowly. I am very concerned that although students write that they would like group work, when they have the opportunity they may abdicate personal responsibility for completing tasks and learning. This must be a significant hurdle for any teacher wanting to break from the standard method of teaching and learning.

It is a concern that students did not appear to benefit from this practical activity. Statistics is a topic that readily lends itself to such engagements, and I will have to rethink the use of hands-on activities with students.

Consequences

The concern over operating in groups providing students with a means of avoiding personal responsibility for completing of tasks suggested altering the requirements of future activities. Groups may require more structure than I would prefer, with tasks nominated and names of individuals recorded beside each task. Unfortunately this relates to the method of operation, and not to the activity itself. However, the organisation is a valuable lesson.

Appendix F6 Summary of Activity 6 with SPAID Responses

Background

Examinations form the focus of events at secondary schools in Brunei Darussalam. While going over the answers to an examination with my Form 6 mathematics class, the students portrayed a degree of passivity and disinterest that I found surprising considering the importance placed upon examinations. At the end of the lesson I asked students to complete responses to the SPAID survey in relation to examinations as a learning activity to help me gain some insight into the students' perceptions of the examinations. This provides an instance of impromptu use of the SPAID.

Responses

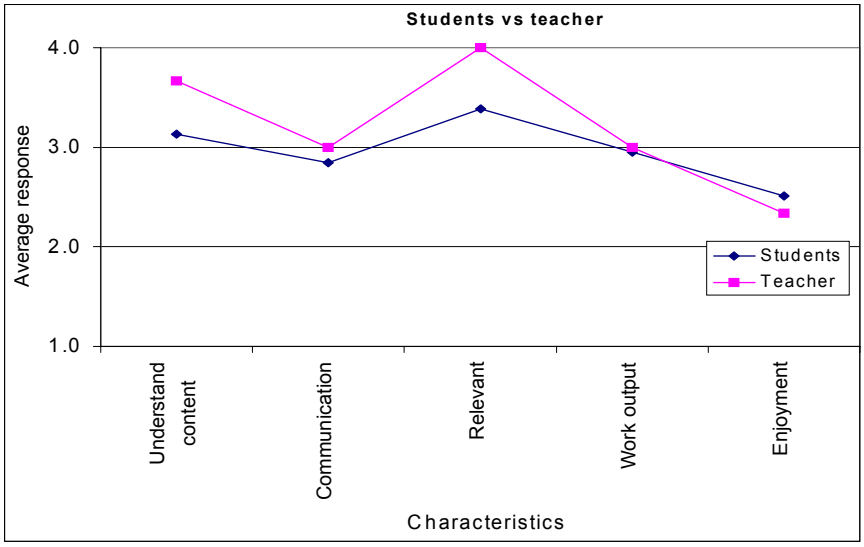

Figure 22. Summary of SPAID responses from Activity 6.

Table 18

Students' Written Responses to the Open-Ended Item for Activity 6

Teacher	*I feel the activity would have been better if...*
	I expect students to be keen to do well in the examination, since it seems to be the focus of the academic culture.

(table continues)

Students	*I feel the activity would have been better if…*
1	More time given.
3	I could understand what the question is and t is easier.
4	More easier question.
5	More not confusing question.
9	I could understand more the questions.
11	The teacher / give better instruction.

Teacher's Reactions

I was pleased with the similarity between my predicted profile of the characteristics and that presented by the students. Two notable differences occurred with the Understanding Content and Relevant characteristics, though I did not consider the differences indicate significant disparity.

The open-ended comments suggested that students had difficulty understanding the questions in the examination. The linguistic structure of instructions and questions in the examination by students mimicked that of past external A-Level examinations. Students had been exposed to several of these examinations to familiarise them with the language and required content level. However, their responses indicated these efforts had not been sufficient. This may have been due to a number of factors; their knowledge of the English language may have been more limited than the vocabulary used, they may have had insufficient understanding of the mathematics required, insufficient exposure to previous examination-style questions, or some other factors. Whatever the cause, the situation must have been highly frustrating for them, and indicating that they may not have had the opportunity to demonstrate their knowledge.

Students had had exposure to a number of past examination questions and I hesitated to give them more of the same. This does appear to be the culture of secondary schooling and I suspect students would feel aggrieved if I did not supply them with the expected routines. However, the concern is that simply supplying more of the same appears to neither improve their understanding of the mathematics involved nor lift their examination results.

Consequences

I will structure the revision of topics to a greater extent than I would prefer, detracting from the aim to generate students autonomous in their learning. Actions will include relating past questions to items within the syllabus and identifying patterns in questions. While this may be considered a standard practice in examination preparation, it appears that these students did not do so for these examinations. Taking time in class to do this may be necessary if students are to prepare for their final examinations.

Appendix F7 Summary of Activity 7 with SPAID Responses

Background

This activity involved the use of isometric drawing paper with a class. The use of isometric paper is not part of the examination syllabus, and I was unaware of other teachers who had used it. Hence, I was a surprised to find several packages of printed isometric paper in a mathematics storage cupboard at school. While teaching enlargement to a Form 4 class, the idea occurred to have students draw combinations of cubes and other shapes on the isometric paper. Enlarging lengths of drawn shapes may then provide an insight to the enlargement relationships between lengths, areas, and volumes.

Drawing three-dimensional shapes on isometric paper required students to visualise shapes, which could be considered a mathematical challenge. In addition, I considered that the activity would provide an enjoyable break from the standard classroom routines.

Students' actions during the activity suggested that they had not been as interested as I had hoped they would be, and so, I was unsure of the worth of the activity. The use of the isometric paper was not planned and the use of the SPAID process provides an example of its impromptu use with a class.

Responses

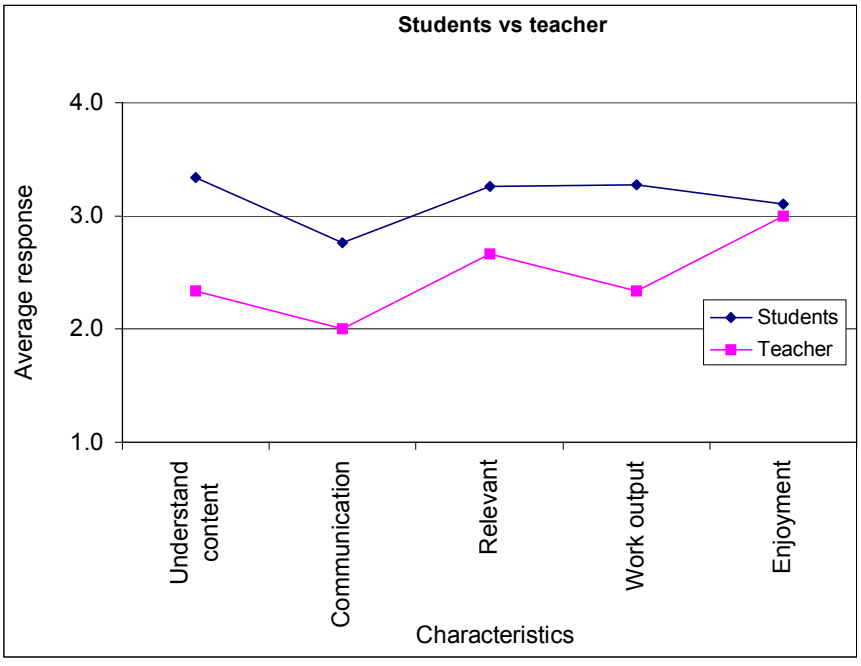

Figure 23. Summary of SPAID responses from Activity 7.

Table 19

Students' Written Responses to the Open-Ended Item for Activity 7

Teacher	*I feel the activity would have been better if…*
	Joined the activity with an exercise that bridges between what they did and examination questions.
Students	*I feel the activity would have been better if…*
1	The subject matter that I did is difficult and need thinking.
2	Register once in a while.
3	Student does his work.
4	Done by every student.
5	Being done everyday.
6	The teacher who is teaching can also converse in Malay.
7	There is no interruption.
8	All students understand what is being explained.
9	I can concentrate when teaching is going on.
10	We can learn faster.
11	It can continue.
12	We can understand as best as we can of what we have been told.
13	We can learn with greater determination and respect the teachers.
14	It is very interesting.
15	It is interesting.
19	We can discuss with other friends.
20	We are using Lego.
21	The teacher taught us very understanding and very sporty (If he can do that!!)
22	Stop doing bullshit.
23	We did more revision on past test paper.

Teacher's Reactions

My estimations of students' responses to most of the characteristics had been lower than the students' average responses, and suggested that students had received the activity more positively than I estimated they had, placating my concern. The use

of isometric paper would likely have been dropped from use with future classes without this feedback.

Of interest was the comment by Student 19, “We can discuss with other friends”. I encourage discussion on matters mathematical amongst students in the class, especially when there may be linguistic challenges. This commented suggests there is a need for cleared communication on this issue.

A few students asked whether their names should appear on their responses, and I believe that the responses would not have been as candid if their comments could have been traced. I did not consider the comment from Student 22, “Stop doing bullshit”, to be offensive. Rather it was his frank statement that the activity had not provided him with the mathematical benefit, enjoyment, or interest it had intended.

Communication provided the lowest response from both the students and myself. The activity was conducted as a natural consequence of events in the classroom, and the improvisation likely contributed to the low communication responses.

Consequences

The first consequence was that the use of isometric paper was not discarded as an activity with future classes. Students’ responses suggested to me that the activity is worth repeating but will require some preparation and planning. The unusual nature of the isometric viewing of shapes may have inhibited some students’ understanding, so there may be a need to introduce students to isometric drawing paper a few times prior to the lesson on scale factors for length, area, and volume.

Appendix F8 Summary of Activity 8 with SPAID Responses

Background

Activity 8 comprised one of the earlier classroom-based activities within the Form 6 Pre-Entry Programme that is outlined in Appendix D of this study. Students were engaged in word logic puzzles, which were chosen because they provided participants with opportunities to process and analyse data, applying what is known to make new discoveries. The requirements of common sense and logical thinking in these exercises were traits useful for students at Form 6 level. Engaging in logic puzzles needed no specialist knowledge, and this was of particular interest as it permitted participation without the entanglement of prior subject content knowledge.

Participants managed attempts at the first few exercises but I found it difficult to identify difficulties they were having, as students remained highly passive, quiet, and subdued for most of the time. This activity was placed relatively early in the Pre-Entry Programme and students were still reluctant to seek assistance from either each other or me as the teacher. Being active in understanding situations and finding solutions is a valued skill both for study and employment, for which previous approaches to schooling appear to have little-prepared these students.

The school was still sorting out practicalities for running these classes and the rooms had not been fully prepared and lacked furniture. This presented some difficulties, with students grouped around the few tables on the limited number of chairs.

Responses

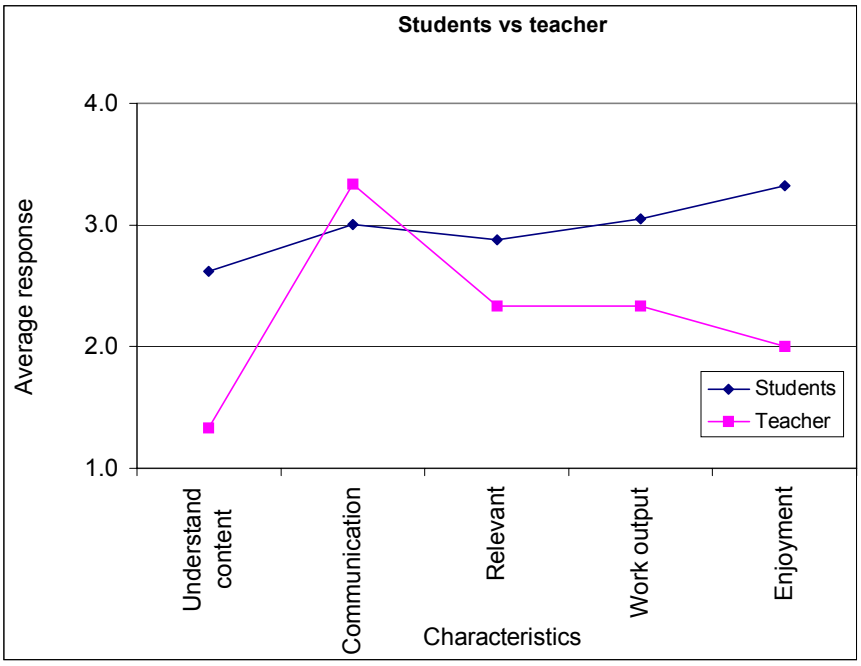

Figure 24. Summary of SPAID responses from Activity 8.

Table 20

Students' Written Responses to the Open-Ended Item for Activity 8

Teacher	*I feel the activity would have been better if…*
	Students had their own desk space; students asked more questions.
Students	***I feel the activity would have been better if…***
1	There were some demonstrations.
2	You give us a lot more difficult questions than usual.
3	There were more fun questions that would help us in our work.
4	I came to class on time.
5	There were other fun activities other than logic problems and more problems.
7	The teacher would just tell us the answer.
8	The English was more easier to understand.

(table continues)

Students	*I feel the activity would have been better if…*
10	The teacher would give more examples on the board concerning this activity.
11	I could understand the clue.
13	We were given more time to think for the answer.
14	We had more problems on the activity.
15	More tables were available.
16	The teacher could tell us more about the clues which were unclear.
17	We were given more time.
18	The question given to us in a bigger form.
19	The explanation of these activity is rather easier.
20	There were more time given on the activity.

Teacher's Reactions

I significantly underestimated the responses by the students in the characteristics of Enjoyment and Understand Content. These may be directly related to the reserved and taciturn character presented by students.

Understanding of some grammatical structures in the puzzles confused some of the students and led to logical contradictions in their conclusions. Knowledge and experience with the English language proved to be a more difficult factor for students than I anticipated. Language will likely remain a challenge for many students while the language of instruction and examination is English, or until the school has enough local teachers willing to operate this programme. Questions and discussion were encouraged during the activity to minimise this aspect with limited success.

Teachers in secondary schools in Brunei Darussalam are constantly reminded of the difficulties that exist when instructing in a language with which students have varying levels of proficiency. While teachers will always attempt to read their audiences so as to alter delivery accordingly, students need to realise they also have an important role in helping the teacher provide sufficient explanation. If students remain passive and present a false impression of understanding, their own learning will suffer.

Participation may be encouraged through allocating individuals to groups of three, with each group being given a different situation. Groups would be required to

present their conclusion verbally to others, which would incorporate the SERP aim of developing skills at presentation.

Consequences

In response to these students' comments the central location for the participants was relocated to the school's Conference Room. The availability of chairs, desks, overhead projectors, and air-conditioning made this a popular decision for students and staff.

Improvements for next year would include providing puzzles that contain simpler grammatical constructions. However, there is a danger that language will always be an issue, and care must be taken to retain the challenge of the puzzles.

A means to encourage students to discuss and collaborate needs to be found. One possibility within this activity is to give each group different puzzles, and require them to present their conclusion to the remainder of the groups, requiring a verbal presentation.

The students who enrol in this course would not know each other. They come from different schools and villages, so may benefit from the use of various icebreaker activities on the first day of the Pre-entry Programme. Staff from the school guidance and physical education departments are in the professional position to possess or obtain knowledge to undertake these activities.

Appendix F9 Summary of Activities 9a to 9e with SPAID Responses

Activities 9a to 9e refer to the five outdoor activities that were conducted within the Maktab SOAS Environmental Research Project (SERP). Information about the Project is given in Appendix D, which pays particular attention to the Orientation activity (Activity 9a) and the Bacteria Culture activity (Activity 9d). Information about Activities 9a and 9d is in Appendix D, but the graphs and open-ended comments are replicated here to provide a summary of responses to the SERP activities.

Activity 9a

Responses

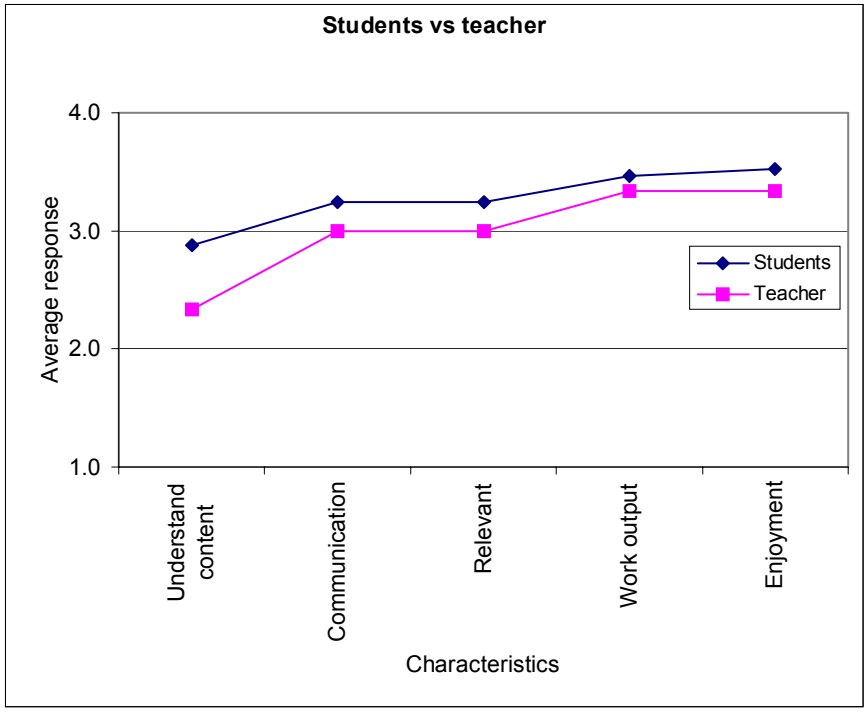

Figure 25. Summary of SPAID responses from Activity 9a.

Table 21

Students' Written Responses to the Open-Ended Item for Activity 9a

Students	*I feel the activity would have been better if…*
1	Would be better if we camped in there.
2	Should be on every week.
4	We spend more time in the jungle with adventure exercises (jungle tracking).
5	The journey was not so long.
6	We spend more time.
7	There is better transportation.
8	We camped in the site.
9	We can have the chance to camp on the project site.
10	The teachers provide us with food supply and better transportation.
11	We are fully equipped.
12	We have enough equipments.
15	It was more coordinated and students were more informed.
16	Girls were included.
17	We spent the whole day doing it (from 8:00 – 4:00 p.m.).
18	Spent more time here.
19	The walk through the research centre was not as tough or far.

Activity 9b

Background

This was the second of the SERP activities to venture into the jungle, and the first to gather data for further analysis. The teacher was the leader of the orientation activity, in which he had been conservative in his estimation of students' responses.

Responses

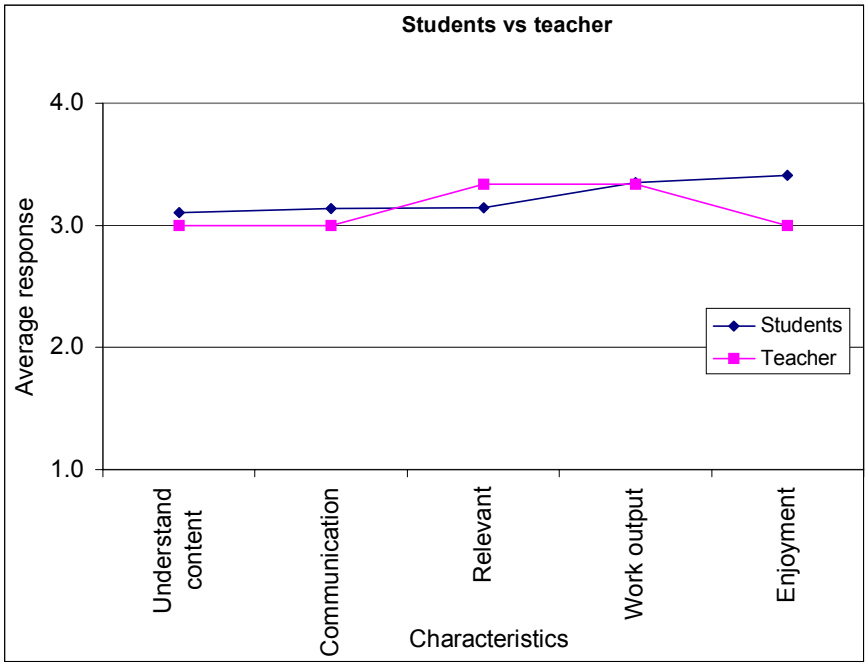

Figure 26. Summary of SPAID responses from Activity 9b.

Table 22

Students' Written Responses to the Open-Ended Item for Activity 9b

Teacher	*I feel the activity would have been better if…*
	Briefing needs to be more thorough.
Students	*I feel the activity would have been better if…*
1	Given more time.
3	More activities are given out.
4	Teachers is able to supply more modern equipment.

(table continues)

Students	*I feel the activity would have been better if…*
5	We were informed (briefed) of it previously (e.g. yesterday).
7	We spent more time.
8	There is a food & drink supply.
9	If given more time.
11	Girls were included.
13	We had spent more time.
14	Camp.
15	We can have a chance to camp/stay over for a day.
16	Spend more time in it.
17	I wore shoes.
18	We had much more time.

Teacher's Reactions

The teacher was pleased with his estimation of the average responses provided by the students. He considered they confirmed his belief in the worthwhile nature of the activity for students in general and let him continue in planning for further SERP activities knowing there was no significant opposition for the Project from the students.

Consequences

Comments led to his developing a clearer briefing outline, in which the importance of correct footwear was stressed.

Activity 9c

Background

The field excursion for this day combined the subjects art and biology. Although art as a Form 6 subject was not available within the school timetable during the year, it would be available in the afternoon should any student wish to take it as an extra subject. All students were given an introduction to the art course during this field trip.

Following the art activity, students engaged the biology activity on which these responses focus. The biology teacher was left feeling that students had not gained a lot from her part of the day and hope to gain some insight from students' responses to the SPAID Survey forms.

Responses

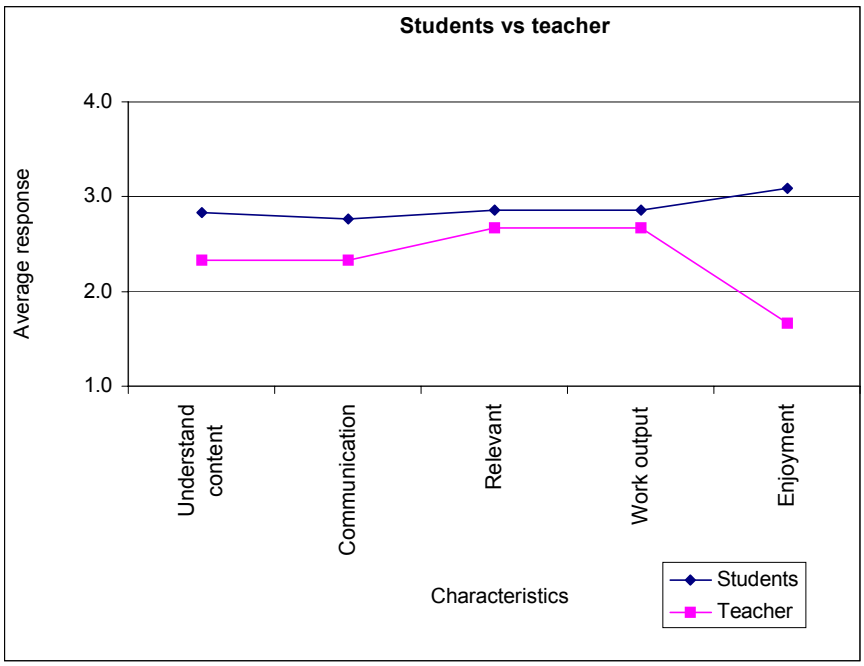

Figure 27. Summary of SPAID responses from Activity 9c.

Table 23

Students' Written Responses to the Open-Ended Item for Activity 9c

Teacher	*I feel the activity would have been better if…*
	Rain had not fallen last night.
Students	*I feel the activity would have been better if…*
2	We have more equipment.

(table continues)

Students	*I feel the activity would have been better if…*
6	We spent more time.
9	We spend more time on doing this activities.
13	There are more work to be done.
14	[Translation] Given the chance to stay in overnight.

Teacher's Reactions

The biology teacher was pleasantly surprised that the students' responses indicated that they enjoyed the activity, as she had no indication of this at the time. The arrangements for the day had left her with a feeling of lack of opportunity to control the events. Students' responses provided no indication of negative reactions towards the activities, and initial concern over whether the activity should be retained were replaced by considering the management of events when replicating the activity in the future.

Consequences

Methods for controlling the issuing of instructions and movements of students were to be revised. Now that she had an idea of the difficulties that were found when controlling the students in the jungle and the time students required to complete tasks, a set of clearer guidelines could be established, including times and locations.

In addition, to increase the use of time in the jungle, the teacher was to discuss the activity with the geography teacher with a view to gathering one set of data for consideration from both geographical and biological perspectives.

Activity 9d

Activity 9d was a field excursion that focused on gathering bacteria to grow in the laboratory. Greater detail is provided in Appendix D.

Responses

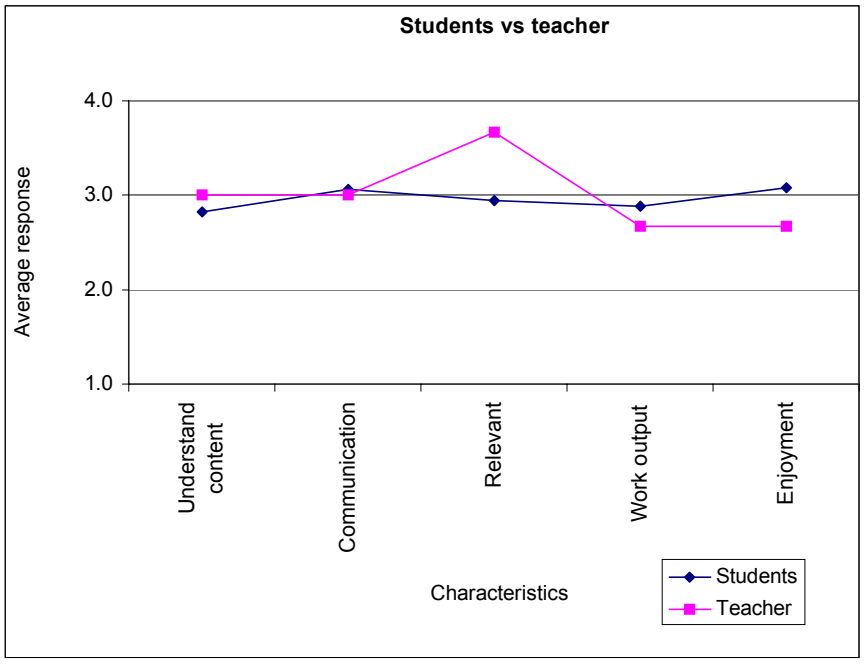

Figure 28. Summary of SPAID responses from Activity 9d.

Table 24

Students' Written Responses to the Open-Ended Item for Activity 9d

Teacher	*I feel the activity would have been better if...*
	We had the right equipment in sufficient number.
Students	*I feel the activity would have been better if...*
2	We can have the chance to camp.
3	We were given more customer service and also more meal.
4	We had more time doing it.
6	It was more organised and equipment was more durable.
9	We spent more time.
12	There are more instrument available to do the project.
13	The activity is done the day before the stream was disturbed by such a heavy rain.

Activity 9e

Background

This activity was the mathematical component within the SOAS Environmental Research Project. The tasks set were to use trigonometry to estimate the volume of a tree and to provide a survey of a portion of the river. The teachers involved had some concern over the limited completion of some aspects of the activities. Central concerns were whether this was due to the aims being too ambitious or whether students had negative perception of the tasks.

Responses

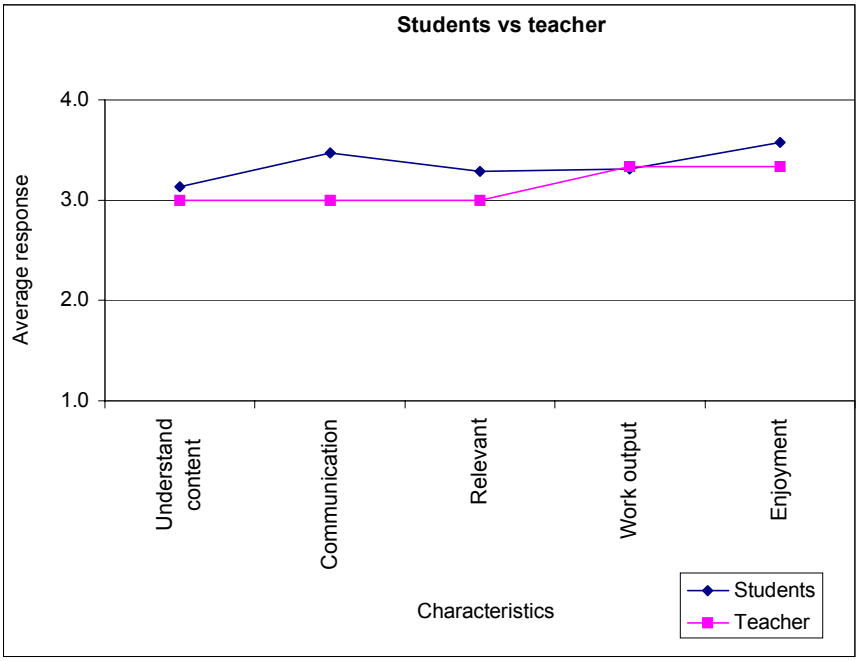

Figure 29. Summary of SPAID responses from Activity 9e.

Table 25

Students' Written Responses to the Open-Ended Item for Activity 9e

	I feel the activity would have been better if…
Leader	We have been given more time to work out the method.
Teachers	Maybe a little more time, although most finished; a little more in–class prep time.
	The wood was dry. Too hard to light fires. All told it was great – students and activity.
Students	*I feel the activity would have been better if…*
5	There are an easier route available to reach the place.
6	We spend more time doing it.
13	There was girl beside us.
15	We had more time doing it.

Teacher's Reactions

The rapidity with which students' responses were available was appreciated by the teacher in charge of the activity, as it alleviated concerns following completing the fieldwork for the activity. He was satisfied with the initial attempt under the given conditions. Time limitations precluded spending more time doing the jungle component, and students' comments that suggested the need for more time (Students 6 and 15) led the teacher to consider how to use the set time more efficiently.

Consequences

The focus moved from whether a new activity should be sought for future SERP events, to considering ways to improve or modify the existing activity. Greater emphasis was to be placed on preparing the students for the tasks, undertaking trials of the processes within the school compound before attempting it in the jungle.

Appendix F10 Summary of Activity 10 with SPAID Responses

Background

This field trip was the third of such excursions for this cohort of students. The activity replicated that undertaken within the preliminary Form 6 Programme and SOAS Environmental Research Project, but on this occasion the students involved were the existing Form 6 student in their second year of the two-year course. The trip was designed to illustrate and review many of the hydrology terms, concepts, and processes that these students are required to know for their examination syllabus.

Responses

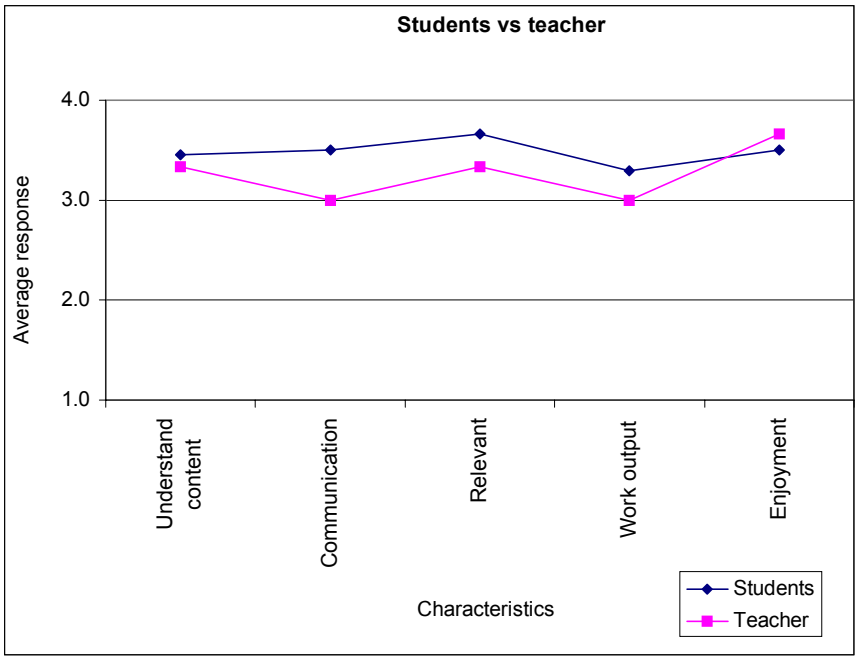

Figure 30. Summary of SPAID responses from Activity 10.

Table 26

Students' Written Responses to the Open-Ended Item for Activity 10

Teacher	*I feel the activity would have been better if…*
	Another hour.
Students	*I feel the activity would have been better if…*
2	We beat the guides to the first spot.

(table continues)

Students	*I feel the activity would have been better if…*
3	We went on a tour bus with a tour guide.
4	We have more time in the jungle.
6	We actually went to the waterfall.
8	More time to look around.

Teacher's Reactions

The teacher was pleased with the general shape of the profiles. He was happy that the communication was a bit below that of the students, as this encourages him to keep looking for improvements in the instructions.

Consequences

The responses provided the teacher with continued support from the students to continue taking groups out of the school compound and classrooms to look at the geographical concepts first hand.

Appendix F11 Summary of Activity 11 with SPAID Responses

Background

This activity was similar to one of those introduced to the Form Two classes mentioned in Activity 1 (Appendix F1), in which several students' comments focused on the consequences that were invoked for getting answers incorrect and referred to as punishment by the students. On this occasion the class was a Form 4 science class and the teacher required students to complete the activities, but removed the punishment aspect.

Responses

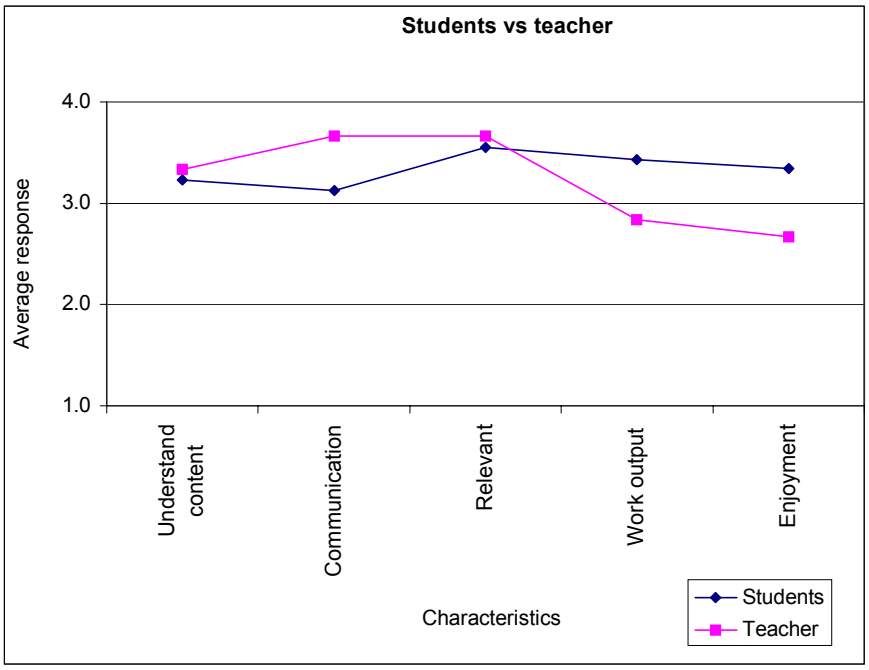

Figure 31. Summary of SPAID responses from Activity 11.

Table 27

Students' Written Responses to the Open-Ended Item for Activity 11

Students	*I feel the activity would have been better if…*
3	[Translation] if it is not imposed or if it does not happen at all.
4	[Translation] I do work which has been assigned.

(table continues)

Students	*I feel the activity would have been better if…*
5	[Translation] Little homework is given.
6	[Translation] we paid more attention to this activity.
7	The activity give more information.
8	Do lots more information in that aktiviti.
9	One a week.
10	If I more understand about this activities.
12	Do lots exercises in the class or activity example experiments, like crossword.
13	I always done it.
14	If you give us a lot of activity like this.
15	If you give us more activity like this.
16	We did a lot of experiments.
17	I can understand what was the teacher say. Understand what is the word.
18	I can understand some of the words.
19	We do once every science period.
20	Give more information.
21	The test is done twice a week.
22	[Translation] If I have a deeper understanding and know its true meaning.
23	Science period has one period in 1 days.
24	The activity sheet are given four times a week.
25	Teacher will give the activity more than one.
26	Add a little more.
27	They are some teacher help us to do the work.
28	If the teacher teaching all of his students carefully.
29	We concentrated to the subject.
31	You make less Homework.
32	This activity was not force.
33	We keep on doing this work.

Teachers' Responses

The teacher was pleased with the averages of students' responses and especially with the open-ended comments supplied by students. While he would have to wait for the next test to assess how much the students were retaining, the comments provided him with some confirmation that the students in this class may learn without the prevalent aspect of punishment.

Consequence

The teacher would continue to develop activities that vary the approaches of students to the learning of content.

Appendix F12 Summary of Activity 12 with SPAID Responses

Background

In this instance the teacher had students prepare revision cards from which they could learn content for tests and examinations. Using revision cards is not a new idea but the students in his class had not used them before. This activity occurred nearly two months into the year with the intention of having students make these cards progressively as topic were completed.

Responses

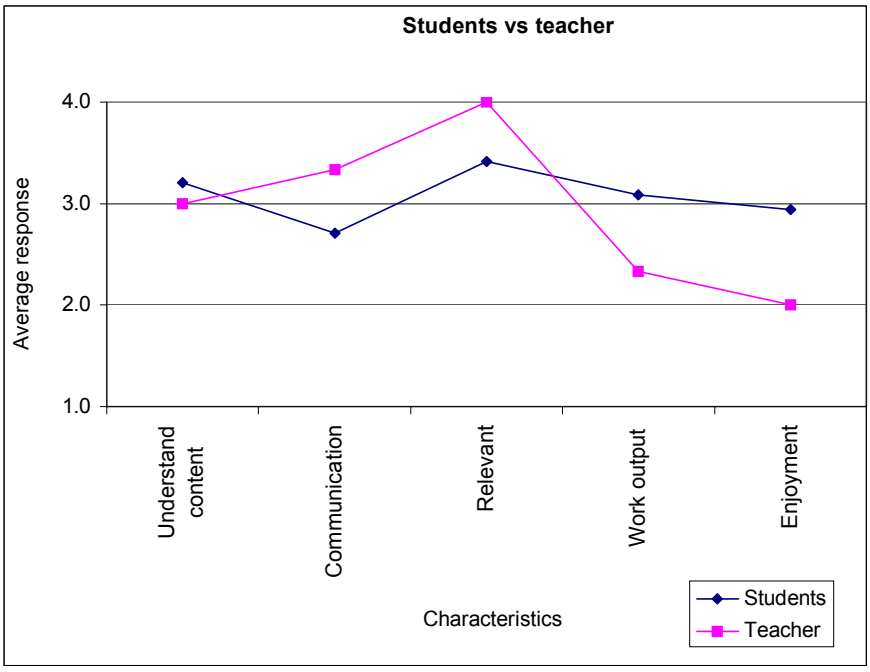

Figure 32. Summary of SPAID responses from Activity 12.

Table 28

Students' Written Responses to the Open-Ended Item for Activity 12

Students	*I feel the activity would have been better if…*
2	The teacher told the answer.
3	The teacher explain the question.
4	Give more concentration to my work.

(table continues)

Students	*I feel the activity would have been better if…*
6	I study very hard to do the activity.
7	Do by group to group to really very understand.
8	Do friends to really very understand.
10	More extra class, more chocolate prize and more experiment and don't forget buy more chocolate.
11	There is more test are given and more chocolate prize are given away.
12	There is more test are given more chocolate are given away.
13	Our teacher correct the cards.
15	(1) The teacher was not strict enough. (2) Friendly with student and explain the work twice.
16	My teacher did not very angry if me not pass up to my teacher.
17	The teacher was not serious. ii) my teacher sometime helps me.
18	The teacher give more explanation slowly.
19	The teacher explain the question with slowly and exactly.
20	We can understand it more than other and make a simple answer and English use.
22	Is useful.
23	We do it once.

Teacher's Reactions

The teacher considered the differences of interest between the average perceptions of students and his estimation of their perceptions to occur in the two characteristics of Work Output and Enjoyment. These provided him with another reminder of the differences that exist between students and teachers. He suspected the students were yet to realise the benefit from developing revision cards as it was relatively early in the year.

Consequences

The absence of negative reactions towards forming their own revision cards provided the teacher with tacit support to continue with the plan.

Appendix F13 Summary of Activity 13 with SPAID Responses

Background

Mathematics instruction and assessment in Brunei Darussalam government secondary schools can be regarded as traditional; examinations dominant assessment and arrangement of desks tend to be in single isles, with students remaining seated during periods of instruction. It was with some surprise that I discovered the mathematics department at the school possessed a number of items designed for practical experimentation. Admittedly, there was no indication that the equipment had had much use, with several still items in their original wrapping.

One section of the syllabus for Form 6 mathematics relates to approximating the binomial distribution using the normal distribution, and the text used by students referred to device called a "quincunx". Included were instructions for making one, along with the suggestion that funding could be recouped through using the quincunx at school fairs to raise money. The description matched two commercially produced objects within in the department's resources. I decided to try using the items with a class of Form 6 students, and the first hurdle was to unwrap the items and to find how to assemble them.

I believe that practical demonstrations and experiments should provide a useful demonstration of theory, but appreciated that the perspectives of students and teachers can vary. Hence, I was interested to obtain some indications of students' impressions of the time spent rolling balls through the quincunx.

Responses

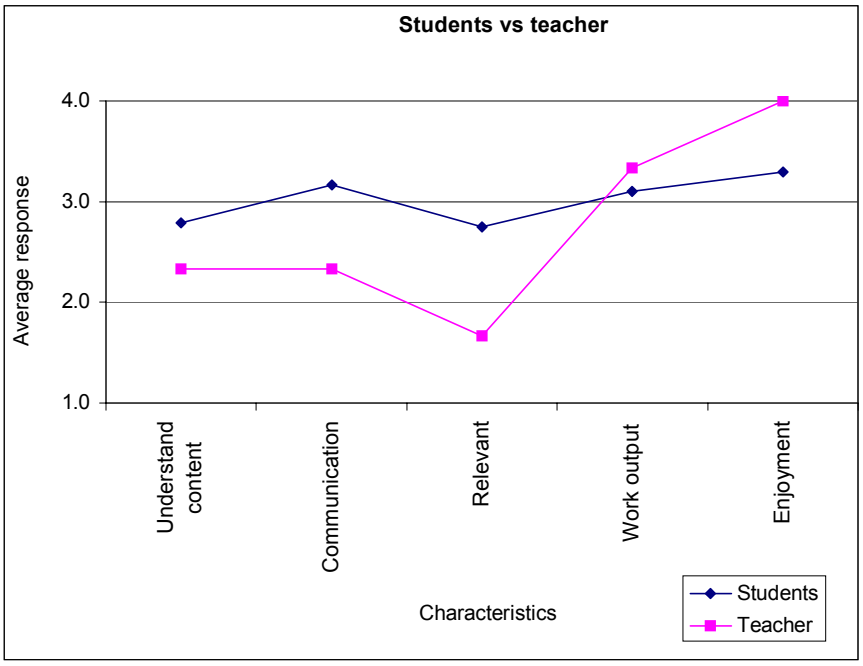

Figure 33. Summary of SPAID responses from Activity 13.

Table 29

Students' Written Responses to the Open-Ended Item for Activity 13

Students	*I feel the activity would have been better if…*
1	We did it slowly.
2	There is more games.
3	There were more of these equipment so that everyone have the chance to do it by themselves.
4	We got more and different types of equipment to play with.
6	We set a limit time for it, and get on with life!
7	We discuss it first then do it!
9	Concentrate on exam papers, only 8 months to go.
10	The instruction booklet was provided!
11	There are more of these stuff available.
12	We did more of the similar activity.
13	The result satisfied us.

(table continues)

Students	*I feel the activity would have been better if…*
14	More explanation was given not by saying it but by writing it down to further understand it.
15	It was done slowly we would have got a close accurate result.

Teacher's Reactions

I had enjoyed the practical aspect of the activity, and was concerned that students were able to link the theoretical work in their textbooks with the results evident during the experiment. Two points were evident to me. First, I considered my underestimation of the Relevance characteristic was pleasing, and second, I continued to have difficulty estimating the Enjoyment characteristic.

Consequences

I will retain the use of the quincunx with this topic, perhaps using it more as a demonstration in the first instance, making the pair of them available for students to experiment with following the formal part of the lesson. One idea is to leave the two quincunx in the classroom over the interval, during which I am certain that the naturally inquisitive nature of the boys would have several of them experimenting, leading to dialogue between students.

Appendix F14 Summary of Activity 14 with SPAID Responses

Background

This is the same group of students who were involved in Appendix F6. A consequence of the use of SPAID in that instance was that I was to undertake a number of revision activities in class that I would have preferred students managed themselves if they were to develop autonomy of learning as students.

Students were given a systematic revision of the content for their forthcoming examination. They read sections of the syllabus and then identified the content in their textbooks and notes. In addition, I had pressed students to begin to take over responsibility for their own revision, but my effort had yielded minimal success. Asking students in the class situation for alternative approaches to study for examination had yielded no alternative ideas to invigorate their revision for A-level examinations. In the search for new ideas I hoped that students would be forthcoming with suggestions through using the SPAID process.

Responses

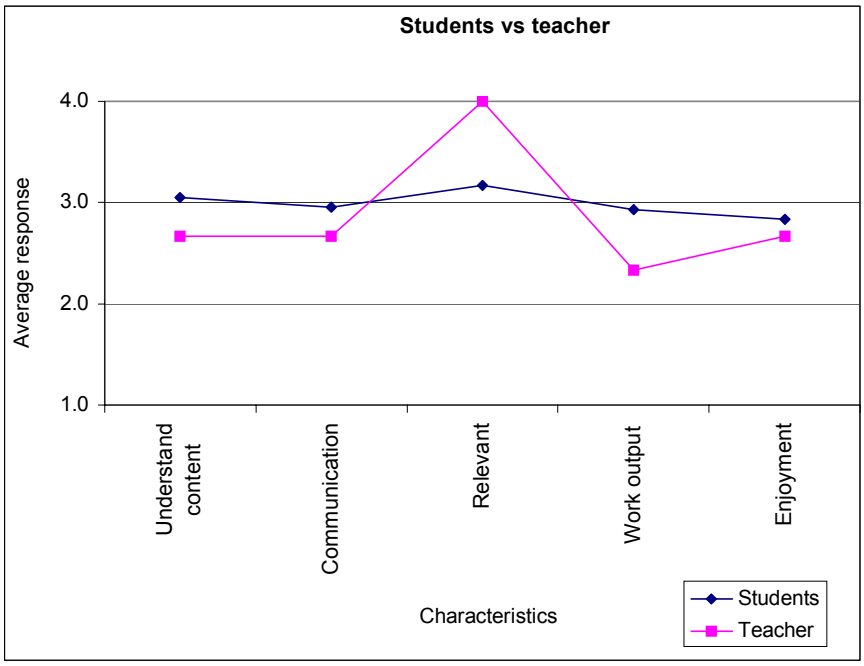

Figure 34. Summary of SPAID responses from Activity 14.

Table 30

Students' Written Responses to the Open-Ended Item for Activity 14

Teacher	*I feel the activity would have been better if…*
	I am not getting as many sets of completed work from students as I expected so I am not sure if students appreciated their part in this activity. Why not? I hope responses to this Survey will give me a few clues.
Students	*I feel the activity would have been better if…*
1	Everyone do at their own time.
2	Haji Bahmin was not in here bugging me for answers all the time.
3	It is sekajap [quick, doesn't take long].
4	I got the further informations.
5	We did it year by year so that we do not leave any questions behind.

Teachers' Reactions

There were no comments notably negative towards the examination revision that I had been directing. Unfortunately, there was also an absence of suggestions for improvements from students. One explanation may be that students are unaware of different approaches to learning. This may indicate a pervasive need for students to be introduced to various learning methods, to explore and develop a method that suits them. These students will soon qualify to attend university where the responsibility for learning rests with the students.

Consequences

Attempts were made to introduce students to different forms of arranging ideas, such as concept mapping. I suspect there is a need to provide students with alternative approaches to learning, particularly those who may qualify for higher study. This is not likely to be a simple matter, requiring a significant change of perspective by students and teachers alike.

Appendix G1 Response by Experienced Teacher A for Ideas to be Considered in this Study

Comments are given in their unedited state.

[UPPER CASE TEXT DENOTES CHARACTERISTIC INDICATED BY COMMENT]

MEASUREMENT OF STUDENTS' PERCEPTION OF AN "INNOVATION".

To be innovative in one's teaching, one has to consider many things that one likes to do but at the same what is intended to be done must make the recipients receptive with readiness, willingness and full commitment that will eventually bring about meaningful and drastic effects in them as well as bring satisfaction to the teachers. It's no use doing an innovative teaching (as to say) if it can only be seen by one or two persons. Innovative teaching is therefore the one that can really be appreciated by all the recipients in the classroom. Meaning, it can really touch them emotionally and caries a lot of meaningful effects [RELEVANCY] that can change the behaviour and actions of the recipients [WORK OUTPUT]. Meaningful teaching will give rise to meaningful learning.

Teachers should be aware that meaningful learning can take place if one's teaching can touch the students emotional "intelligence". This means to say that the teachers' actions through meaningful actions in the classroom should convey meaningful meanings to the students. Teachers' meaningful actions such as going around the class helping them with their work, checking their work "regularly, carefully and properly", returning their work on time and giving extra help beyond school hours are among the value-added actions that are valued by students and parents in this region. Once that are deployed, the teaching will be seen by students as meaningful and innovative one.

Bad or ineffective communication [COMMUNICATION] is another factor which most teachers fail to see in their teachings. Too much of flowery words will make students baffle without understanding. High frequency language or high level of language used is also ineffective way of disseminating information Most teachers are aware of using high level language in their teaching to teach students who are not able to comprehend. We must communicate with effective illustrations and action [COMMUNICATION] that can be seen by students. Some teachers fail to do this. They spend a lot on talking without giving any illustrations ands meaningful actions. Some do but illustrations given do not compliment what is given verbally. Most teachers fail to "understand and see" what their students want to grasp from what is given to them. Most teachers fail to "swim deep" into the students mind. Some do not seem to make the trouble or spend a little bit of their time to recognise the importance of knowing their students better personally in their course of teaching. (This is how I felt when I was a student).

Students Culture as well as parents culture [PARENTS/COMMUNITY] play an important part in our teachings and students learning. In this region, teaching is still considered by students and parents to be an important activity in school with its main purpose is to make them pass their examinations [RELEVANCY] with flying colours. This means to say that examination is very much valued and still the top priority in the students life in this region. So, those teachers who are able to bring their students from the brink of failure to the door of success in the examination are considered to be an effective and innovative teachers by their students and parents. If teachers fail to see their expectations, they will be considered to be ineffective and uninnovative teachers instead. This explains why foreign teachers find that after few months of teaching they feel dissolution and disappointment when coming to this

region because they “cannot” see and understand this embedded cultures that have been inherited by students generations after generations.

Appendix G2 Response by Experienced Teacher B for Ideas to be Considered in this Study

Teacher B's responses were returned within to my initial letter. *Relevant sections of this letter are presented below in italic type* and the teacher's responses to these sections are presented in Roman type.

OUTLINE

Teachers in Brunei Darussalam are encouraged to incorporate a variety of activities in their teaching that may be considered "innovative" for many. There has been a greatly increased awareness of alternative approaches to many aspects of teaching and learning over the last few years, about which teachers have justification to be cautiously eclectic.

Yes, although some are old teaching methods, many consider them "innovative". I think you need to qualify why the teachers need to be cautiously eclectic. My view is that to use any "new" methods, the teacher must start using it, use it a few times to be skilful before getting any success or improvement. The success of the methods depends very much on the type of students and the suitability/compatibility of the teacher's style/attitude/etc.

Over the last 20 years or so, much work has been done regarding the use of students' perceptions of their learning environments. A considerable number of instruments has been developed to encompass various aspects, all considered useful and practical. It would be advantageous for informed decision making to utilise a common instrument to provide timely and pertinent data regarding students' perceptions of any new activities a teacher may trial.

Yes.

A request by a teacher for a method to measure effects of changing teaching methods led to considering several existing instruments for their suitability. None of those surveyed was deemed sufficiently practical for the purpose. It is with considerable reluctance that the idea is mooted to construct yet another instrument.

Good idea. Although I am not sure if an instrument is the answer to measuring changes. I think there are several variables here too - e.g. the time the lesson was

taken, the mood of the students, the mood of the teacher, the content/skill/attitude that is being developed, etc.

What effects on students' perceptions do you think would be useful for the teacher to know when they attempt to implement an "innovative" teaching method with a class?

Whether they like it; enjoyed it [ENJOYMENT]; can adapt to the teaching method used;

their responses; whether they are on task [WORK OUTPUT]; their understanding of the concept/ task [UNDERSTAND CONTENT];

their ability to use the skill [WORK OUTPUT] that are being developed;

their attitude towards their learning [ENJOYMENT];

Achievement is naturally high on the list. Can you think of aspects of this or any others? Answers will be considered in forming dimensions/scales of the instrument.

This will depend on the subject and the objectives of the lesson, I would have thought.

Appendix G3 Response by Experienced Teacher C for Ideas to be Considered in this Study

Comments are given in their unedited state.

This contributor was engaged in a personal project that focused upon a particular teaching strategy. This contrasted with this thesis that focused upon obtaining indications of students' perceptions of any activity. Teacher C's responses were also returned within my initial letter. *Relevant sections of the letter are presented in italic type* and the teacher's responses presented in roman type.

The instrument will have the specific role of providing class teachers in Brunei Darussalam with information that will encourage and assist them to improve their attempts at introducing innovations into teaching and learning. It will need to be practical, a criterion to be considered in relation to the frequency and variability of use, as well as its effectiveness in helping teachers modify subsequent delivery of activities.

Hi, that's my current project you are talking about!! Are you going or intend to do the same, or are you convince of the worthy of my concerns about teaching pedagogy in Brunei?

What effects on students' perceptions do you think would be useful for the teacher to know when they attempt to implement an "innovative" teaching method with a class?

I am no expert. I will try to share with you what is worth of my experience.

Teachers who are involved with any "innovation" needs to be convinced that it is a worthwhile cause. Teachers needs to internalised the worthiness before taking up any action. Without that the project will be half "doomed".

Teachers' attitude plays an important part in transpiring what he/she is trying to introduce into the classroom. In fact, every lesson can be innovative or is an innovation to the students, if the teachers believe in what he/she is doing. It has a

great influence in students' perception whether the approach is worthwhile "listening" or "interesting".

Of course, there are students' understanding and previous experiences with the subject play a vital role too. Listening to the students comments and finding out why they are doing things the ways they are, are crucial to an effective teaching. Most of the time, the focus is on satisfying the authorities or the school requirement then fulfilling the students' needs!!

This is evidented in teachers' comments, "we don't have time to complete the syllabus if I have to do innovative teaching!" So, the shortest way to achieve the result will be adopted. Very often the approach is for short term rather than long term benefits. I don't know. This is a whole new culture and we are in new era. It's hard. That's why the teachers had to be very firm with their beliefs and not to give up easily. It's not easy unless with the appropriate backup and support.

Must not neglect parents, the communities, authorities' perceptions too [PARENTS/COMMUNITY].

Achievement is naturally high on the list. Can you think of aspects of this or any others? Answers will be considered in forming dimensions/scales of the instrument.

Parents and Authorities here are not as patience. They want to see quick and immediate returns. Difficult to handle. As we all knew, there is no perfect formulae. Whatever innovation it is, it will benefit only some. Is this 'some", as how much that is important. Majority or minority? It is hard to tell on the onset. A methodology might be very successful in one school might not be the same in another school!! Students composition, social background, standard and support from parents, schools and authority play a part.

Appendix G4 Response by Experienced Teacher D for Ideas to be Considered in this Study

Firstly, is it intended that this instrument to be subject specific - i.e. is it intended for science only? The things that one might be trying to achieve and methods used in science could be quite different to say English.

Why? Do students understand (or think they understand) why they are they are doing a task [RELEVANCY]?

Enjoyment. Does the activity make learning fun? [ENJOYMENT]

Understanding. Do students understand (or think they understand) the work better? [UNDERSTAND CONTENT]

Application. Can students apply what they have learned to new and different situations? [WORK OUTPUT]

Recall. Do students remember the activity and what they were supposed to have learnt a few days later? [UNDERSTAND CONTENT]

Confidence. Does the student have confidence that the teacher knows what he/she is doing? Is the student confident that the method used will help them to learn/help them to pass the exam [RELEVANCY]. (I think this confidence aspect is very important. I think one of the differences between an experienced teacher and a new teacher is that the experienced teacher is able to instil confidence in the student).

Appendix G5 Response by Experienced Teacher E for Ideas to be Considered in this Study

Good to include communication [COMMUNICATION], involving vocabulary, dialect, and accent.

Examinations [RELEVANCY] are the nub of the problem. If it's not in the syllabus then the students feel they ought not to consider it.

For years these kids and teachers have been hammered into thinking that the totally blinkered approach (no sideways glances, traditional rote-recall, "fill and drill") is the only way that matters. Considering things other than exams is very hard for them.

Appendix G6 Identification of characteristics from Comments by the Five Experienced Teachers Appendices G1 to G5

Teacher A Appendix G1	Teacher B Appendix G2	Teacher C Appendix G3	Teacher D Appendix G4	Teacher E Appendix G5	Characteristics
	Understanding of the concept		Understanding. Recall – explain to a friend. Help them to learn.		UNDERSTAND CONTENT
Communication, illustrations and action.	Understanding of the task.			Communication.	COMMUNICATION
Appreciated by all the recipients. Meaningful effects. Pass examinations.			Students understand (or think they understand) why they are doing a task. Help them to pass the exam.	Examinations.	RELEVANCY
Change the behaviour and actions.	On task. Ability to use the skill.		Apply what they have learned.		WORK OUTPUT
	Like it; enjoyed it. Attitude towards their learning.		Enjoyment		ENJOYMENT
Student/parent culture		Parents, the communities, authorities' perceptions			

Appendix H1 Teacher Response Sheet Following Use of SPAID: Trigonometry Teacher in Appendix C

These responses relate to my use of the SPAID package following undertaking the trigonometry activity outlined in Appendix C. All responses were discussed with two teaching colleagues to ensure that my comments accurately reflect my impressions at the time.

Survey response sheet

Thank you for having your classes complete the survey about students' perceptions of the activity that you did with your class and for completing the teacher version of the same survey.

The idea is to help improve the effectiveness of the activities you try with classes. In order to get some feedback regarding the use of this survey, please complete the following questions where possible.

The activity	
What was the activity you did with the class? (Very brief description in about 20 words)	Measure the height of a building by estimation, scale drawing, and by trigonometry.
How many classes tried the activity?	2
The survey should not take a lot of time for students or teachers to complete.	
Approximately how many minutes of class time did each class take to complete the survey?	10, 7
Approximately how many minutes of your time did it take to obtain the results of the survey for each class?	10, 10
Did you manage to *obtain results* from the survey with one class *before* presenting the activity to the next class?	Yes.
Were you able to make use of the computer programme to obtain results?	Yes.

(*table continues*)

Improving the Survey	
Did you or your students notice any problems with the survey?	They seemed to get on with it OK. None asked me to clarify any item.
Were there any problems you faced during the survey?	No. I used the time to collect the rulers and clinometers.
Did you notice any problems for the students when they were completing the survey?	There was a little discussion between students about a couple of the items. I suspected this was due to difficulty with using the English version, as there was also some page turning. This may have been so they could read both linguistic versions. All seemed to be making a genuine effort to give honest responses.
The effectiveness of the survey	
Have you compared your own responses with those of your students?	*Yes.*
Were any of the results different from what you expected? (Your own, your students', or both).	Understand Content and Enjoyment with Class 1.
Were there any results that you considered pleasing?	The students seemed to be in favour of the activity – it was good to get positive feedback so soon after doing the activity with Class 1. My close estimation of three of the characteristics let me know some of my impressions were close.
Did you find any of the results useful?	Yes. The Communication result indicated that the students had a good idea that they knew what they were to do, while the Understand Content result suggested that they had trouble getting the benefit from the activity that I had hoped.
Did/would you alter the delivery of the activity for different classes based upon results from this survey?	Yes. I broke the tasks into smaller units, and got the second class to do one task before I demonstrated the next.
How would you alter the delivery of the activity the next time you try it?	Keep the basic format using the worksheet and the three parts to the activity. Keep the instructions simple and demonstrate each.

Did you learn anything about your students' thinking from the results?	Getting students to work collaboratively and to use their initiative is very difficult.
Will you try the same or a similar activity again in future years or sooner?	Yes, especially Class 2 who do not usually seem to enjoy their maths.
Any general comments?	I believe this is an excellent activity for students. Not just for the trigonometry, but for developing thinking students.

Appendix H2 Teacher Response Sheet Following Use of SPAID: Orientation Activity Teacher in Appendix D

Survey response sheet

Thank you for having your classes complete the survey about students' perceptions of the activity that you did with your class and for completing the teacher version of the same survey.

The idea is to help improve the effectiveness of the activities you try with classes. In order to get some feedback regarding the use of this survey, please complete the following questions where possible.

The activity	SERP: Orientation activity.
What was the activity you did with the class? (Very brief description in about 20 words)	Jungle walk and initiative tasks.
How many classes tried the activity?	1
The survey should not take a lot of time for students or teachers to complete.	
Approximately how many minutes of class time did each class take to complete the survey?	12
Approximately how many minutes of your time did it take to obtain the results of the survey for each class?	15
Did you manage to *obtain results* from the survey with one class *before* presenting the activity to the next class?	NA
Were you able to make use of the computer programme to obtain results?	Yes. The graphs were fine – easy to follow.
Improving the Survey	
Did you or your students notice any problems with the survey?	No. This was the first time they completed the form and all seemed happy to do so.
Were there any problems you faced during the survey?	None. It gave me a chance to get all the equipment together before we drove back to school.
Did you notice any problems for the students when they were completing the survey?	Students were not joking or fooling as they completed the forms. All seemed to answer the survey seriously. All seemed to understand the questions.

(*table continues*)

The effectiveness of the survey	
Have you compared your own responses with those of your students?	*Yes.*
Were any of the results different from what you expected? (Your own, your students', or both).	I think I was conservative in my original estimates.
Were there any results that you considered pleasing?	They show that the students were in favour of this type of activity. This was a major concern here, since we are doing an entirely new thing. I was only interested in the Communication and the Enjoyment bits. The others did not apply much to this activity.
Did you find any of the results useful?	Knowing that no student was against what we did was good.
Did/would you alter the delivery of the activity for different classes based upon results from this survey?	We have a much better idea about what to do now. There were many loose ends as things kept changing on us. Next time I will be able to give students much clearer instructions.
How would you alter the delivery of the activity the next time you try it?	Leave it much the way it was. The walk was not long. The jungle is on their back doorstep and they never go into it.
Did you learn anything about your students' thinking from the results?	It was good spending the whole day with them and to see them react in a different environment. The boys are not used to doing things outside.
Will you try the same or a similar activity again in future years or sooner?	Definitely.
Any general comments?	This seemed to be a good start to the Project. The students seem interested and I am looking forward to the other activities.

Appendix H3 Teacher Response Sheet Following Use of SPAID: Biology Activity Teacher in Appendix D

Survey response sheet

Thank you for having your classes complete the survey about students' perceptions of the activity that you did with your class and for completing the teacher version of the same survey.

The idea is to help improve the effectiveness of the activities you try with classes. In order to get some feedback regarding the use of this survey, please complete the following questions where possible.

The activity	SERP: Biology Bacteria Culture.
What was the activity you did with the class? (Very brief description in about 20 words)	Riparian assessment. – sampling water and organisms in the river.
How many classes tried the activity?	1
The survey should not take a lot of time for students or teachers to complete.	
Approximately how many minutes of class time did each class take to complete the survey?	Under 5 minutes. Students have filled it in several times previously and they seemed to know what to do.
Approximately how many minutes of your time did it take to obtain the results of the survey for each class?	10
Did you manage to *obtain results* from the survey with one class *before* presenting the activity to the next class?	NA
Were you able to make use of the computer programme to obtain results?	Yes
Improving the Survey	
Did you or your students notice any problems with the survey?	It took me a while to get into the thinking of the survey. This wasn't easy to do. Students seemed fine.
Were there any problems you faced during the survey?	Had to think about it carefully, which is a good thing. We need to do more of this sort of thing.
Did you notice any problems for the students when they were completing the survey?	No, they seemed to know what to do.

(*table continues*)

The effectiveness of the survey	
Have you compared your own responses with those of your students?	Yes
Were any of the results different from what you expected? (Your own, your students', or both).	Yes, the students enjoyed it more than I thought. There really was a lot of rain the night before and the river was very muddy. I thought it would put them off.
Were there any results that you considered pleasing?	The Enjoyment. I expected it to be much lower.
Did you find any of the results useful?	They are all very useful. They let me know what to reteach – give me ideas of things to change. But, I was mostly interested in Communication and Enjoyment – did they know what to do and did they enjoy doing it. These two seemed fine, and from the graphs the results for Relevance was curious. Looks like I will need to think about that a bit more.
Did/would you alter the delivery of the activity for different classes based upon results from this survey?	There was not much time to do the biology. The students' comments say the same thing – more time was needed. The way it was arranged, I ended up having to chase up individuals in order to let them know what to do. If I had been able to do all the students in one go it would have been better. This would give me more control over the instructions.
How would you alter the delivery of the activity the next time you try it?	Add parameters. Set more specific details of what the students were to do. Geography and we had a very similar idea here. I would find out more of what they were doing and hopefully combine to use the same data.
Did you learn anything about your students' thinking from the results?	They were keener on this sort of thing than they seemed to be to me. I really thought they did not like doing it, but I was wrong.

(*table continues*)

Will you try the same or a similar activity again in future years or sooner?	Sure. It is a good thing to do with these boys – even from a general environmental point of view.
Any general comments?	The graphs make things easy to see.

Appendix I Short List of Potential Ideas and Items for Use in this Study

DEVELOPING ITEMS FOR SCALES

1. UNDERSTANDING AND RECALL OF CONTENT

Do students think they understood the ideas that the activity tried to get across?

Do students think they will remember the content?

Key Ideas:

Understand the content,

Explain what the activity was about to a friend or younger brother or sister,

Remember the content of the activity,

Remember content for tests and examinations.

Initial ideas for items:

1 I can remember the content of the lesson,

2 I can explain the content of the lesson to a younger brother or sister,

3 I will remember the ideas of the lesson in two weeks,

4 I will remember what we did for the next test,

5 I know why we did what we did today,

6 The lesson helped me remember what I need to know for examinations.

2 COMMUNICATION

Do students think they understood the spoken and written words used?

Key Ideas:

Well organised,

Efficient,

Clear instructions,

Knew what had to be done (potential confusion with Content).

Initial ideas for items:

1 *I knew the words that the teacher used today,*

2 *I was confused about what we were to do today* (negative item),

3 *The instructions were clear,*

4 *The teacher explained things clearly,*

5 *The lesson was well organised.*

3. RELEVANCE

Do students think they know why they did the activity?

Do students think the activity will help them get a better mark in examinations?

Do students think they can apply the idea to new situations?

Key Ideas:

Waste of time,

Useful (to the student),

What we did today is important,

The tasks were related to preparing for tests and examinations,

Helped with learning for tests and examinations.

Initial ideas for items:

1 *I think what I did today will help me do better in the exam,*

2 *I see how what we did will be useful in sitting tests,*

3 *What we did today belongs is science/mathematics,*

4 *What I did is useful to me,*

5 *What I did relates to other things we have done in class,*

6 *What I did helped me understand what I have to know for examinations and tests,*

7 *What I did will help me learn for examinations.*

4. WORK OUTPUT

Do students think they did more work than they usually do?

This relates to doing work set in class, homework and revision for examinations.

Key Ideas:

Did a lot of work,

Effort,

Participate in the lesson,

Cooperate,

Think quite hard,

Will do any homework from the lesson,

Have done the work for this activity well.

Initial ideas for items:

1 *I intend to do my homework* (though homework would not necessarily follow),

2 *I did the class work,*

3 *I will complete my class work,*

4 *I was busy doing the work during the lesson,*

5 *I participated in the lessons*,

6 *I worked hard in the lesson,*

7 *I think I have done the work for this activity well.*

5. ENJOYMENT

Did students enjoy the activity?

Key Ideas:

Paid attention during the lesson,

Enjoyed the activity,

Look forward to doing something like this again,

Satisfaction,

The activity was very interesting,

Liked doing the activity,

Want to do more activities like this.

Initial ideas for items:

1 I enjoyed the lesson,

2 I liked the lesson,

3 I want to do more of this type of lesson,

4 The lesson was fun,

5 I paid attention to what we did today,

6 I am happy with what I did in the lesson today,

7 I am satisfied with what I did in the lesson today,

8 I am pleased with what I did in the lesson today,

9 I was interested in the lesson today.

Appendix J Example of the Displays Generated Through the Use of the SPAID Package.

Students' Perceptions of Activities Instrument and Display

Activity: Example
Date: 1Apr00
Class: 4Z9

Enter the responses to the Survey from the teacher and for each of the students in the spaces with the blue border.

ITEM RESPONSES

	1U	2C	3R	4W	5E	6U	7C	8R	9W	10E	11U	12C	13R	14W	15E		
Teacher	2	3	3	4	2	3	3	4	2	1	3	2	3	3	1		
	Help understand	*Understood instr*	*Was useful*	*Tried my best*	*Enjoyed*	*Explain to friend*	*Understood how*	*Help in subject*	*Happy to do*	*Want more*	*Help remember*	*Confused*	*Useful for tests*	*Wanted to do*	*Boring*	*1 = male 2 = female*	*1 = Malay 2 = Engli*
Student	*1U*	*2C*	*3R*	*4W*	*5E*	*6U*	*7C*	*8R*	*9W*	*10E*	*11U*	*12C*	*13R*	*14W*	*15E*	*Sex*	*Version*
1	3	3	3	3	3	3	3	3	3	3	3	2	3	3	1	1	1
2	4	3	2	3	3	3	4	2	3	2	3	3	3	3	3	2	2
3	3	2	3	1	2	2	3	1	1	4	1	2	3	1	1	1	2
4	3	3	1	2	3	2	3	3	3	3	2	2	2	2	3	2	2
5	3	3	3	4	3	3	3	4	3	3	3	2	3	2	2	1	2
6	4	3	2	4	3	4	3	3	3	2	3	3	3	3	3	2	2
7	3	3	2	3	2	2	2		3	3	3	2	2	4	3	2	1
8	4	3	3	4	3	2	4	4	3	3	2	3	3	3	2	1	2
9	3	3	2	3	2	2	4	2	3	3	2	1	2	2	1	2	1
10	4	2	2	4	4	4	2	3	4	2	3	3	2	4	1	2	2
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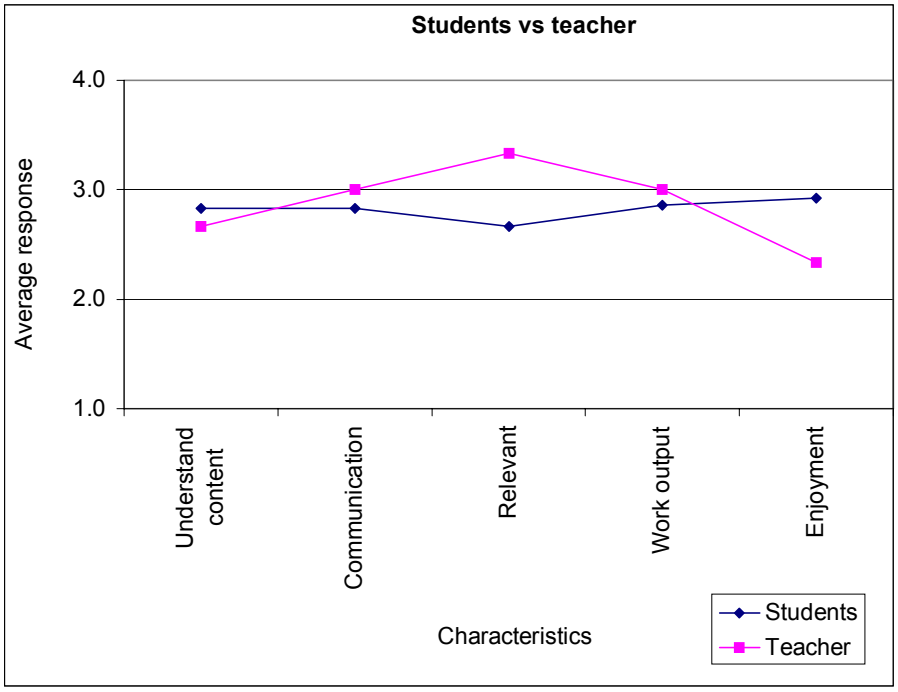
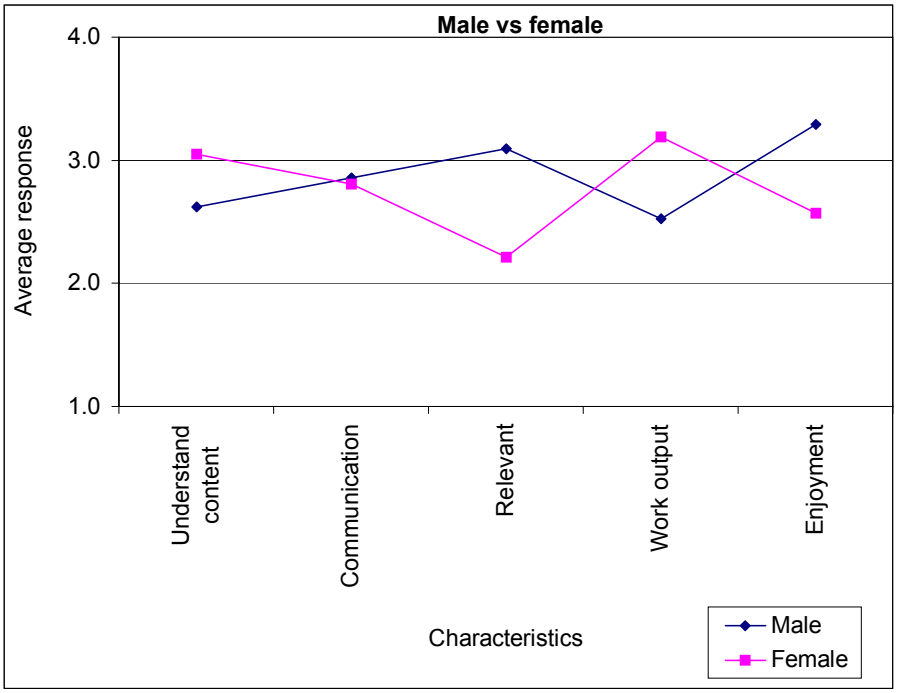
40																	
Average	**3.4**	**2.9**	**2.5**	**3.2**	**2.9**	**2.7**	**3.1**	**2.9**	**2.8**	**2.8**	**2.4**	**2.5**	**2.6**	**2.6**	**1.9**		
	1U	*2C*	*3R*	*4W*	*5E*	*6U*	*7C*	*8R*	*9W*	*10E*	*11U*	*12C*	*13R*	*14W*	*15E*		
1	0	0	1	1	0	0	0	1	2	0	2	1	0	2	6	7	4
2	0	2	6	1	4	6	2	3	1	4	5	6	6	4	3	7	10
3	8	11	6	6	7	6	9	5	9	8	7	6	8	6	5		
4	6	1	1	6	3	2	3	4	2	1	0	1	0	2	0		

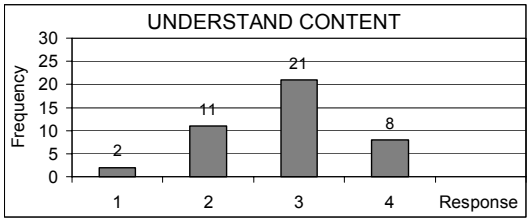
This PAGE 2 graph gives a general idea of the differences between the students' reactions to the activity and how the teacher thought they reacted.



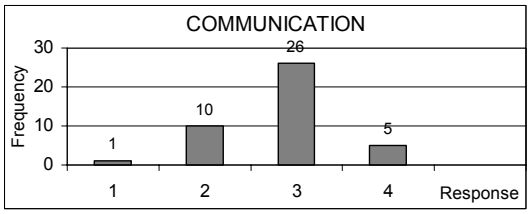
This PAGE 2 graph gives you a general idea of the differences between the male and female students' reactions to the activity.



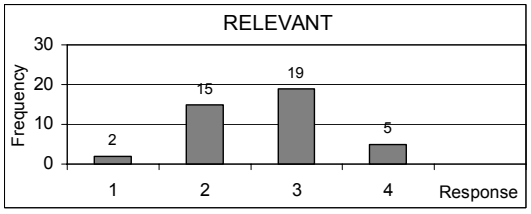
Graphs on PAGE 3 give a frequency summary of students' responses to each of the five main domains.



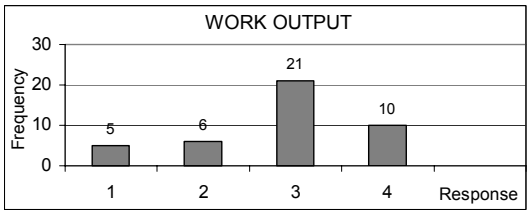
How well students consider they understood the content of the activity compared with usual school work.



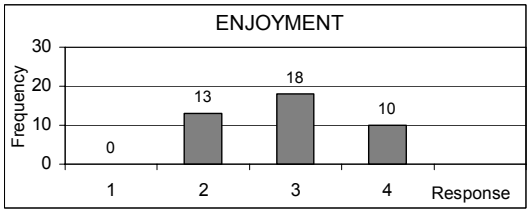
How well students consider they understood the instructions for the activity compared with usual school work.



How relevant students consider the activity compared with usual school work.



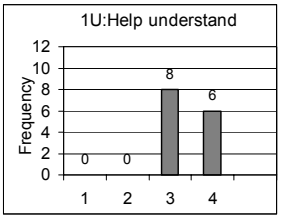
How hard students think they worked compared with usual school work.

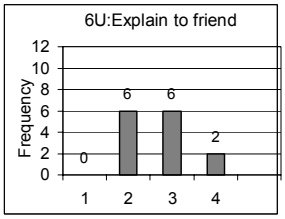


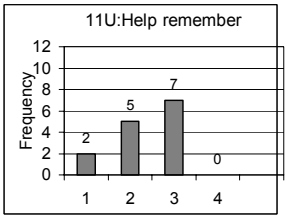
How enjoyable students found the activity compared with usual school work.

Graphs on PAGE 4 show the frequencies of students' responses to each of the items in the survey.

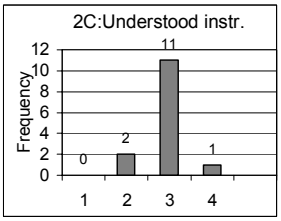
UNDERSTAND CONTENT

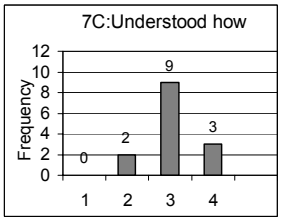


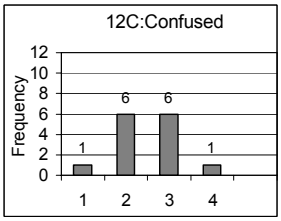




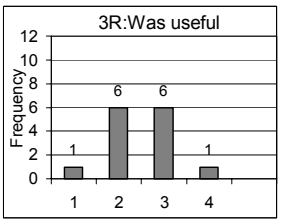
COMMUNICATION

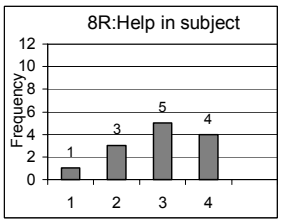


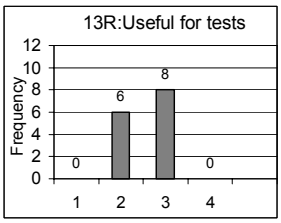




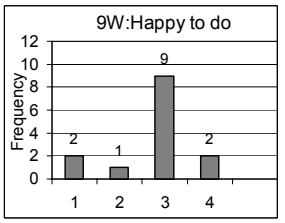
RELEVANT

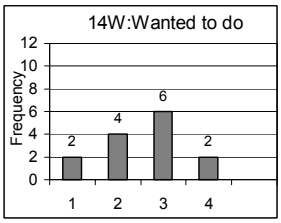




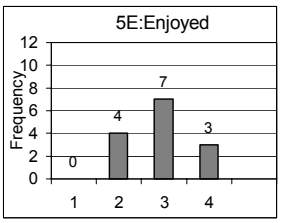


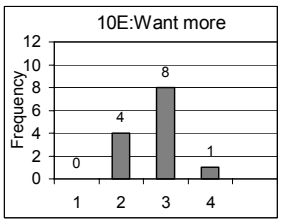
WORK OUTPUT

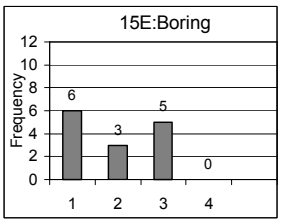




ENJOYMENT

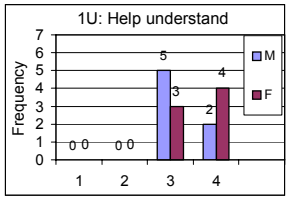


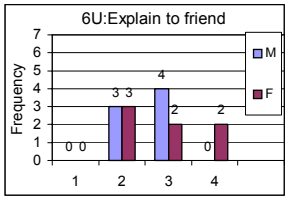


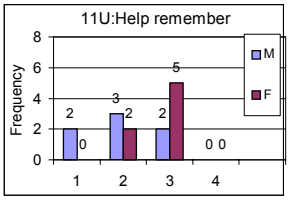


Graphs on PAGE 5 show the frequencies of male and female responses to each of the items in the survey.

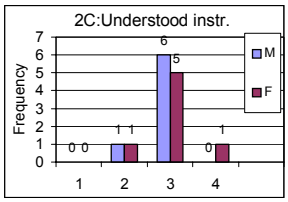
UNDERSTAND CONTENT

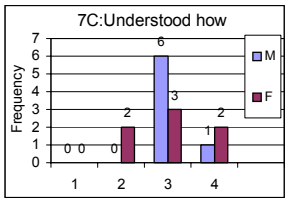


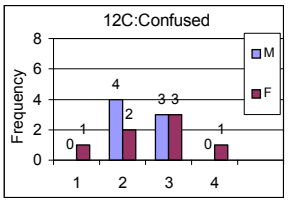




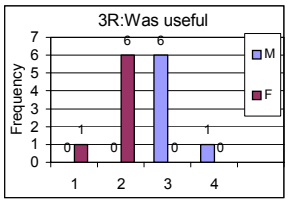
COMMUNICATION

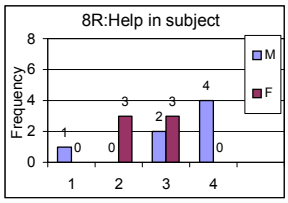


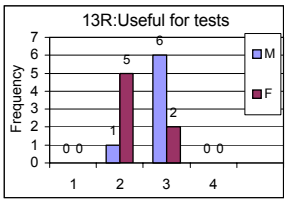




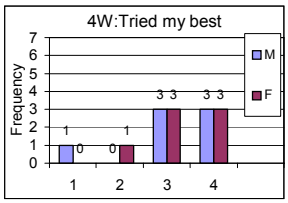
RELEVANT

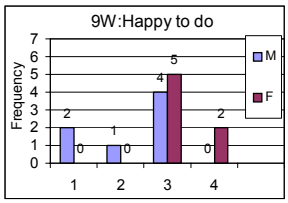


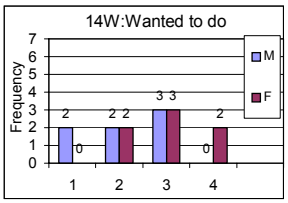




WORK OUTPUT







ENJOYMENT